Final
Environmental Assessment for Construction of BRAC Infrastructure Upgrades and the Human Performance Wing Complex in the Area B Hilltop District Wright-Patterson Air Force Base

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Wright-Patterson Air Force Base
88th Air Base Wing
Environmental Management Division

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FINDING OF NO SIGNIFICANT IMPACT AND
FINDING OF NO PRACTICABLE ALTERNATIVE
FOR
CONSTRUCTION OF BRAC INFRASTRUCTURE UPGRADES AND THE HUMAN PERFORMANCE WING COMPLEX IN THE AREA B HILLTOP DISTRICT, WRIGHT-PATTERSON AFB OH

Pursuant to the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1500-1508) for implementing procedural provisions of the National Environmental Policy Act, Department of Defense Directive 6050.1 and Air Force regulation 32 CFR 989, the 88th Civil Engineer Directorate, Environmental Management Division has prepared an environmental assessment (EA) to identify and assess potential environmental effects of constructing the Human Performance Wing (HPW) complex within Area B Hilltop District of Wright-Patterson Air Force Base (WPAFB), Ohio. As part of this action, associated infrastructure would be upgraded. This EA is incorporated by reference into this finding.

Under the 2005 Base Realignment and Closure (BRAC) Commission final report, they recommended organizations from Brooks City Base, Texas, Naval Research Laboratory, Florida, and Mesa Research Site, Arizona be relocated to WPAFB to create HPW, a center of excellence for aerospace medicine research. BRAC also mandated AFRL/SN from Hanscom AFB and Rome NY be realigned to form the Sensors Directorate. Because these complexes are independent of one another, a second EA will be prepared to address environmental impacts associated with this action. When Congress approved the Commission's recommendations, BRAC became law; therefore, WPAFB is the only installation under consideration and analysis is focused on locations on the installation.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Alternative 1 - Proposed Action (EA Section 2.1, pages 9 – 21): Two new facilities approximately 700,000 gross square feet would be constructed along side Fifth Street in the Area B Hilltop District and house approximately 1,200 persons (EA, Figure 2). The HPW facility north of Fifth Street would consist of three building "modules" industrial in nature and have high security requirements. The HPW facility south of Fifth Street would house the majority of laboratories as well as teaching and administrative space. A service yard adjacent to the north HPW facility would contain cooling towers, transformers and emergency generators. To support this complex, existing infrastructure (roadways; electrical, communications, steam and water distributions systems; and sanitary and storm sewers) would be upgraded or replaced. A dry detention basin would be installed to handle increased storm water runoff. As part of the road improvements, Gate 19B would be relocated to the existing intersection of Reese Drive and National Road (EA, Figure 3). To accommodate the footprint of the HPW complex and gate relocation, Facilities 20430 and 20682 would demolish.

Alternative 2 – No Action (EA Section 2.2, page 21): Under this action, the HPW facility construction would not occur and infrastructure upgrades would not be made. Because this is a

BRAC action and WPAFB will be the beddown location for HPW, the no action serves as a baseline against which the proposed action and other alternatives are compared to.

Alternative 3 (EA Section 2.3, pages 21 – 22): Under this action the infrastructure upgrades described in Alternative 1 would be phased to coordinate with the construction of each facility.

Alternatives Eliminated from Further Study (EA Sections 2.4 - 2.5, pages 22 – 26): The only alternative meeting the needs of the HPW complex was Area B Hilltop District. This site had the required acreage needed to support the administrative, educational and laboratory needs associated with HPW and was within the vicinity of AFRL/HE, a collaborating partner.

Several roadway alternatives where developed and analyzed; however, traffic analysis showed the relocation of Gate 19B to Reese Road was the only alternative that met the needed traffic capacity and security requirements allowed for useful modifications along National Road, avoided close proximity of signalized intersections, and provided good traffic circulation within Area B.

ENVIRONMENTAL CONSEQUENCES

It was determined implementation of Alternatives 1 and 3 would have no impact to Health and Safety, Socioeconomics and Environmental Justice. All other environmental impacts are identified below and would be the same for each alternative.

Natural Resources (EA Section 4.2, pages 65 – 70): Approximately 95% of undeveloped area within the project site is comprised of maintained lawns or open fields; therefore, impacts to local vegetation and wildlife would be minimal.

Relocation of Gate 19B would require the removal of two small wetlands (EA Figure 10). Both of these wetlands are defined by Ohio EPA as Category 2 and require a Section 401 permit under the Clean Water Act (CWA). U.S. Army Corp of Engineers (USACE) has determined these wetlands and drainage areas north of Fifth Street affect waters of the United States; therefore, a 404 permit under the CWA will be required. WPAFB has submitted a preliminary plan to these regulatory agencies following USACE Mitigation Guidelines and Checklist for Ohio. Under this plan WPAFB would enhance Wetland B1 in Area B (EA Figure 11); typically a 1.5:1 ratio for wetland replacement. Other wetland mitigation measures WPAFB may be required to follow include removing invasive exotic vegetation, enhancing aquatic resources, debris removal, shoreline stabilization, and introduction of native wetland vegetation.

While threatened and endangered species have not been identified within the HPW footprint, the gate relocation area contains a number of mature trees, which may be suitable summer roosting locations for the endangered Indiana bat. To determine if these bats were present, WPAFB conducted a survey in July 2007. Indiana bats were only found along the Mad River 1.7 miles from the project area. WPAFB is currently in coordination with U.S. Fish and Wildlife Service (USFWS) regarding potential Indiana bat summer roost trees. To minimize potential impacts to this species, WPAFB will implement mitigation measures outlined in their Integrated Natural Resources Management Plan, which has been approved by USFWS. As part of this plan, tree cutting will be

limited to 15 Sep – 15 Apr when the bats are hibernating and would least likely be present. Any additional measures USFWS imposes will be implemented by WPAFB.

Water Resources (EA Section 4.3, pages 70 – 76): Implementation of this action would increase impervious surfaces by 70% causing a substantial increase in storm water runoff. To reduce this impact, a new underground storm sewer network would be installed and lead to a dry detention basin north of First Street (EA Figure 8). This detention basin would be designed to empty within 48 hours to ensure it would not be a water attractant for birds.

Because the project area is greater than 1 acre, the construction contractor will be required to submit Ohio EPA a site-specific storm water pollution prevention plan addressing erosion control measures. These measures can include construction access drive, storm sewer inlet protection, use of silt fencing, straw bales and/or hydro-mulching, etc. As part of the plan, the contractor will be required to follow maintenance and inspection procedures identified by Ohio EPA and upon completion of construction, re-establish vegetative cover. There would be no impact to ground water or the 100-year floodplain.

Hazardous Materials/Waste (HAZMAT), Stored Fuels and Installation Restoration Program (IRP) (EA Section 4.4, pages 77 – 81): It is estimated the HPW complex will use a variety of HAZMAT but exact quantities are unknown at this time. Using historical data taken from similar waste generating activities, it is estimated there will be a 40% increase in HAZMAT from inbound BRAC missions. Because this increase takes into account the HPW needs as well as the other BRAC action, Sensors Directorate, a new hazardous waste storage facility may be constructed. This construction will be evaluated in the second BRAC EA since it is not ripe for decision.

The HPW complex will require fuel storage tanks to support multiple generators. The tanks will be sized to hold enough fuel for 24 hours of full operation. Since the HPW complex is still early in the design phase, generator and fuel tank specifications have not been provided to the base for determination of any applicable SPCC requirements. As soon as they are available for review, the Environmental Management Division will make the applicable regulatory determinations and ensure that any regulatory requirements (such as obtaining permits) are adhered to.

There are several IRP sites located adjacent or within roadways that may need resurfacing or replacing (EA Figure 10); however, impacts to these sites would be short-term and minor.

Land Use (EA Section 4.5, pages 81 – 82): Implementation of this action would change land use designation from open space to research and development. This change is consistent with the WPAFB General Plan, which states future land use plans should consolidate research and development into discrete campus environments to increase efficiency.

Relocation of Gate 19B would bisect the existing par course fitness trail east of Q Street into two courses. This, coupled with the removal of mature trees, would diminish the park-like setting; however, impacts are minor.

Soils (EA Section 4.6, pages 82 – 84): There would be temporary impacts to soils from site preparation and excavation activities. These impacts would be minimized by implementation of erosion controls as specified in the storm water pollution prevention plan.

Cultural Resources (EA Section 4.7, pages 84 – 87): The Hilltop District has been determined to have a low likelihood of containing archaeological artifacts because of past disturbance. Furthermore, no historic buildings would be directly affected by this action. Facilities 20430 and 20682 have been determined ineligible for listing in the National Register of Historic Places.

The project area, specifically improvements to roadways and potable water system, is within the vicinity of Adena mound. To ensure this resource is not impacted, WPAFB Cultural Resource Manager will identify to the construction contractor a buffer zone 40 feet around the mound and conduct weekly inspections to ensure encroachment has not occurred. On August 2007 the State Historic Preservation Office concurred with WPAFB findings the proposed work will have no adverse effect on historic properties provided protective measures are taken for construction near Adena mound.

Air Quality (EA Section 4.8, pages 87 – 90): There would be short-term impacts to air quality from construction activities but they would be temporary and end once construction was complete.

It is estimated the HPW complex would require 60,000 pounds of steam generated from the Area B Heating Plant to support their operations. This increase does not exceed the Title V permit limits nor does it trigger conformity analysis. At this time, specifications for the generator and fuel tank have not been disclosed to WPAFB to determine if any applicable air permits are required. Once available, the Environmental Management Division will make the applicable regulatory determination.

Noise (EA Section 4.9, pages 90 – 92): There would be short-term impacts on ambient noise from construction activities; however, these impacts would be minimized by completing activities during normal working hours.

Transportation/Traffic (EA Section 4.12, pages 95 – 99): There would be short-term impacts during roadway construction; specifically intermittent road closure and traffic delays. A traffic plan would be implemented to maintain through traffic along National Road. Once roadways were upgraded, there would be a positive, long-term benefit. Road improvements would enhance traffic circulation in Area B and improve primary arterial capacity. The new gate would provide increased capacity for queuing vehicles through security checks. All National Road improvements will be coordinated with Greene County.

Utilities (EA Section 4.13, pages 99 – 103): Completion of the project would bring long-term, beneficial impacts to utilities by improving capacity, service lines and redundancy within the area. The wastewater line replacement will be coordinated with the city of Dayton for sections occurring within the Mad River well field.

Cumulative Impacts (EA Section 4.15, pages 104 – 106): Projects planned in Area B during FY 2007 and FY 2008 include the demolition of Facility 20464, renovation of Facility 20023 and the partial demolition of Facility 20450. In addition, infrastructure upgrades for the Information Technology Center and the Materials Computation Research Facility, and additions to AFIT would be taking place. Other BRAC facility construction, namely the Sensors Directorate expansion, also is expected to occur in the near future. Collectively, these projects would comprise approximately 130 acres of land in the Hilltop District. Approximately two-thirds of that area is currently open space and the rest is developed, such as existing roadways, building sites, or parking lots. Upon completion of construction, approximately 25 percent of the development area would be returned to maintained open grass area. There will be a cumulative loss of open space in the Hilltop District as a consequence of these developments.

PUBLIC NOTICE

A public notice was posted in the Dayton Daily News on 8 August 2007 with the comment period closing 7 September 2007. No comments were received.

FINDING OF NO SIGNIFICANT IMPACT

Based on my review of the facts and analysis contained in this EA, which is hereby incorporated by reference, I conclude both Alternatives 1 and 3 will not have a significant impact on the natural or human environment. An environmental impact statement is not required. This analysis fulfills the requirements of the National Environmental Policy Act, the Council on Environmental Quality and Air Force regulation 32 CFR 989.

FINDING OF NO PRACTICABLE ALTERNATIVE

Taking the above information into consideration, pursuant to Executive Order (EO) 11990, Protection of Wetlands, and the authority delegated by Secretary of Air Force, order 791.1, I find there is no practicable alternative to the actions proposed in the wetlands and Alternatives 1 and 3 include all practicable measures to minimize harm to the environment. This finding fulfills both the requirements of the referenced EO and Air Force regulation 32 CFR 989.14 for a Finding of No Practicable Alternative.

21 Sep 07

TIMOTHY K. BRIDGES, SES
Director of Communications,
Installations, and Mission Support

Date

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APPENDIXES

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AFI	Air Force Instruction
AFIOH	Air Force Institute of Operational Health
AFIT	Air Force Institute of Technology
AFPD	Air Force Policy Directive
AFRIMS	Air Force Restoration Information Management System
AFRL	Air Force Research Laboratory
AICUZ	Air Installation Compatible Use Zone
ANSI	American National Standards Institute
APE	area of potential effects
APZ	Accident Potential Zone
AST	aboveground storage tank
AT/FP	antiterrorism/force protection
bgs	below ground surface
BHE	BHE Environmental, Inc.
BMP	Basewide Monitoring Program
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAA	Clean Air Act
CATV	community antenna television
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	corrugated metal pipe
CO	carbon monoxide
COBRA	Cost of Base Realignment Actions
CRM	Cultural Resources Manager
CWA	Clean Water Act
dB	decibel
DoD	United States Department of Defense
EA	environmental assessment
EFDZ	earthfill disposal zone
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement

LIST OF ACRONYMS (cont'd)

EO	Executive Order
EQM	Environmental Quality Management Inc.
ESA	Endangered Species Act of 1973
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
FPCON	Force Protection Condition
FR	Federal Register
ft^2	square feet
ft^3	cubic feet
FY	fiscal year
gpcd	gallon per capita per day
gpm	gallon per minute
gsf	gross square feet
HAZMAT	hazardous material
HE	Human Effectiveness
HPW	Human Performance Wing
HW	hazardous waste
I-675	Interstate 675
ICI	International Consultants Incorporated
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ITC	Information Technology Center
kV	kilovolt
kW	kilowatt
KZF/BWSC	KZF Design and Barge, Waggoner, Sumner and Cannon
lb/hr	pounds per hour
LOS	level of service
mgd	million gallons per day
MILCON	military construction
MSA	metropolitan statistical area
msl	mean sea level
MVA	megavolt amperes

LIST OF ACRONYMS (cont'd)

n/c	not counted
NAAQS	National Ambient Air Quality Standards
NAMRL	Naval Aerospace Medical Research Laboratory
NCO	noncommissioned officers
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NLC	National Library of Congress
NOI	notice of intent
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
Ohio EPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method
ORC	Ohio Revised Code
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyl
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
POL	petroleum, oil, and lubricant
PTI	permit to install
PVC	polyvinyl chloride
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
RFP	request for proposals
RWBS	Radioactive Waste Burial Site
SAIC	Science Applications International Corporation
SCS	Soil Conservation Service
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide

LIST OF ACRONYMS (cont'd)

SPCC	Spill Prevention Control and Countermeasure
SR	State Route
tpy	tons per year
USACE	United States Army Corps of Engineers
USACERL	United States Army Construction Engineering Research Laboratory
USAF	United States Air Force
USAFSAM	United States Air Force School of Aerospace Medicine
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
WPAFB	Wright-Patterson Air Force Base
WWTP	wastewater treatment plant

1.0 Purpose and Need For Action

1.1 Introduction

The U.S. Department of Defense (DoD) is reorganizing its base structure to more efficiently and effectively support U.S. forces, increase operational readiness, and facilitate new ways of doing business, in accordance with the Defense Base Closure and Realignment Act of 1990 (BRAC). The purpose of BRAC is to realign military assets with the current threats and to eliminate excess capacity and reduce costs by sharing facilities to a greater extent. Excess capacity is defined as underused or unused facilities and/or infrastructure. Current BRAC efforts placed greater emphasis on joining organizations from different services that have a similar focus. Joining appropriate organizations from two or more services to share facilities in the right location can significantly improve organizational effectiveness while reducing costs.

1.2 Background

The 2005 BRAC Commission mandates realigning several DoD missions with similar focus to Wright-Patterson Air Force Base (WPAFB), Ohio (Figure 1). The closure of Brooks City Base in Texas, the Naval Research Laboratory in Pensacola, Florida, and the Mesa Research Site in Arizona under the 2005 BRAC process gives the U.S. Air Force (USAF) an opportunity to create a new organization to be named the Human Performance Wing (HPW), a center of excellence for aerospace medicine research. The HPW would encompass the following USAF aerospace medicine research, training, and consultative organizations:

- U.S. Air Force School of Aerospace Medicine (USAFSAM) Training, Education, and Consultation missions presently located at Brooks City Base, Texas
- Air Force Institute of Operational Health (AFIOH) Campus presently located at Brooks City Base, Texas
- Air Force Research Laboratory (AFRL) Human Effectiveness (HE) Directorate Warfighter Readiness, Biosciences, and Aerospace Medical Research missions, presently located at WPAFB; Brooks City Base, Texas; and Mesa, Arizona
- Naval Aerospace Medical Research Laboratory (NAMRL) currently located at Pensacola Naval Air Station, Florida

The mission of the HPW would be collocated into a new complex in the WPAFB Area B Hilltop District. The north HPW facility would be bounded by 1st Street, 5th Street, Q Street, and Hobson Way. The south HPW facility would be bounded by 5th Street, 10th Street, Q Street, and Hobson Way. The proposed location of the new HPW complex is provided on Figure 2, although minor changes may occur during the detailed design phase of these facilities. In total, approximately 700,000 gross square feet (gsf) of new facilities are anticipated to be constructed in the Area B Hilltop District.

The new HPW complex and required infrastructure upgrades comprise a significant construction program. To fund, manage, and execute the construction in the midst of ongoing operations at existing facilities, the construction of the HPW complex and associated infrastructure have been divided into two military construction (MILCON) projects: an infrastructure upgrade component would proceed first, followed by construction of the new HPW complex.

There also are other missions that will relocate to WPAFB under BRAC. These other missions are not located within the HPW complex project area and will be assessed in a subsequent environmental assessment (EA).

This EA was developed to assess and present the potential environmental consequences associated with the construction of new infrastructure and replacement of existing infrastructure and the construction of the new HPW complex in the Area B Hilltop District of WPAFB, Ohio. The cumulative environmental impacts of the BRAC construction program are assessed to be insignificant.

This EA has been performed in accordance with the National Environmental Policy Act (NEPA) of 1969; 40 Code of Federal Regulations (CFR), Part 1500; the Council on Environmental Quality (CEQ) regulations implementing NEPA; and the USAF Environmental Impact Analysis Process (EIAP) (32 CFR Part 989).

1.3 Purpose and Need for the Proposed Action

The 2005 Defense BRAC Commission forwarded a Final Report on September 8, 2005, completing its review of initial BRAC recommendations made by the Secretary of Defense and provided its list of recommended base closures to the President. The President accepted the Commission's recommendations and forwarded them to Congress. Since Congress did not disapprove the recommendations within the time period provided under law, the recommendations are required by law to be implemented; therefore, those 2005 BRAC recommendations associated with WPAFB must be implemented as stated in the Final Report without any deviation or consideration of alternate locations. As such, WPAFB is the only installation under consideration for the actions described in this EA. Now USAF, along with the other military services, is required to execute the 2005 BRAC decisions and conduct the environmental analysis of the proposed actions. While seven actions identified in the 2005 Final Report will result in realignment of military organizations to WPAFB, five are being evaluated in this EA. This EA identifies and evaluates these five actions along with the associated activities that are inherent to implementing the actions.

1.4 Project Description

WPAFB proposes to construct approximately 700,000 gsf of new HPW facilities in the Hilltop District both on the north and south sides of 5th Street. The footprints of the proposed new facilities are within the area of the proposed infrastructure upgrades. North and south parking lots would be required for the respective buildings, with a central lot to the east supplying the remaining population a location that can serve both buildings simultaneously. The proposed architecture in the *35% Request for Proposal (RFP) Design of the HPW Complex* (KZF Design and Barge, Waggoner, Sumner and Cannon [KZF/BWSC], 2007a) for the new facilities would be a maximum of four stories with precast, brick and glass banding. It is anticipated that the building foundations for the new facilities in the Hilltop District would range from 8 to 13 feet below grade. Although the final design is not complete, the HPW complex is further described in Section 2.2.

Infrastructure modifications are needed in the Area B Hilltop District to provide adequate site utilities, communications, traffic control, and roadways to support operations at these new facilities. An extensive analysis of the existing infrastructure has been performed for the proposed HPW site

(KZF/BWSC, 2007b). The analysis shows that the supply of water, electricity, natural gas, and steam heat is adequate to meet the needs of the new facilities, although several new supply lines must be installed to the locations of the new facilities. Also, a number of utility lines must be relocated around the proposed facility sites. The capacity of the wastewater collection system also is adequate, although there are several locations where the existing wastewater pipes must be replaced because of capacity or age. The addition of buildings and parking lots would create additional impervious surface. This increase is expected to triple the peak storm water runoff from the area. Additional storm water collection and detention systems are needed to manage the flow of storm water from the site and minimize impacts to the receiving streams.

The facilities infrastructure upgrade addresses the main infrastructure needed to provide the required utilities to service the HPW facilities. The infrastructure upgrades would largely be located in the Hilltop District, in the eastern portion of Area B (Figure 1). The infrastructure upgrades that are needed in the Hilltop District include:

- Steam heating
- Water
- Wastewater
- Natural gas
- Electrical service
- Communications
- Storm water management facilities
- Roadways

Many of the infrastructure upgrades are repair and replacement or enlarging existing lines in the Hilltop District. Several existing lines would be relocated around the footprints of the proposed facilities. New lines to provide connections to main lines would be installed to the new facility sites. Some minor improvements to the wastewater system in the Downtown District (Figure 2) would also be included. All utilities that would be replaced or upgraded are located within WPAFB boundaries.

Upgrades of the internal roadway system in the Hilltop District would be made to accommodate the expected increase in traffic with the BRAC and other programmed facilities. The proposed improvements include widening several existing roadways, and adding dedicated turn lanes and traffic control signals at several intersections. These additions would provide the capacity and traffic control needed to accommodate the expected traffic volumes. Details of the roadways that would be improved in the Proposed Action are provided in Section 2.

Gate 19B provides primary access to the Hilltop District. Analysis of traffic flow at Gate 19B indicates that there is sufficient capacity to handle the vehicles entering and exiting the base from this area; however, security checks conducted for people entering the gate slow traffic flow and result in backups on both the north and southbound approach lanes on National Road. Traffic congestion is the result of inadequate entrance capacity through the gate and insufficient storage lengths between the gate and National Road to handle the backups. The expected 20 percent increase in vehicles at this gate with the HPW missions would cause a further degradation of operations at Gate 19B.

To improve access to the Hilltop District from the surrounding roadway system, WPAFB proposes to relocate the existing Gate 19B along National Road with a gate at the existing Reese Drive intersection. The proposed gate would provide greater queuing capacity and more checkpoint lanes to offset the expected increase in inbound traffic. Additional dedicated turn lanes also are proposed along National Road at the new Gate 19B location to maintain through traffic operations at this intersection.

Although the final design is not complete, infrastructure upgrade requirements have been identified and are further described in Section 2.1.1.

1.5 Decision to be Made

The purpose of this EA is to analyze the environmental impacts of the Proposed Action and its alternatives (including the No Action Alternative). Based on the evaluation in this EA, a determination would be made as to whether there are significant environmental impacts expected

from the Proposed Action. The evaluation in this EA would result in a Finding of No Significant Impact and of No Practicable Alternative (FONSI/FONPA) if environmental impacts are not significant or in the determination that an Environmental Impact Statement (EIS) must be prepared if environmental impacts are significant. This EA provides the decision maker and the public with information required to understand the short-term and long-term consequences of the Proposed Action and its alternatives.

1.6 Scope of Environmental Analysis

The Proposed Action and alternatives are evaluated for potential environmental impacts to these elements of the natural and human environment:

- Natural resources
- Water resources
- Land use
- Hazardous materials (HAZMAT)/hazardous waste (HW), stored fuels, and Installation Restoration Program (IRP)
- Soil
- Cultural resources
- Air quality
- Noise
- Health and safety
- Socioeconomics
- Transportation/traffic
- Utilities
- Environmental justice

1.7 Regulatory Requirements

Statutes and regulations to which USAF must comply are summarized in Table 1. The regulatory requirements are listed under each appropriate category in Section 3.

TABLE 1
Summary of Applicable Environmental Compliance Requirements for the Proposed Action and Alternatives

Potential Environmental Impacts	Applicable Statutes and Regulations
Natural Resources	• AFI 32-7064, Integrated Natural Resource Management Plan • Endangered Species Act of 1973, 16 USC §1531 et seq. • 50 CFR Part 200 Wildlife and Fisheries • 50 CFR Part 402 Endangered Species Act of 1973 • 33 CFR Parts 320-330 Discharges of dredge and fill material into waters of the U.S. • Executive Order 11988 – Floodplain Management • Executive Order 11990—Protection of Wetlands • 40 CFR, Part 6, Appendix A—Protection of Floodplains • 40 CFR, Part 6, Appendix A—Protection of Wetlands • 40 CFR, Part 230—Protection of Wetlands • 40 CFR, Parts 320-330—Protection of Wetlands • CWA, Section 404 • ORC 1531.25, Protection of Species Threatened with Statewide Extinction
Land Use	• AFI 32-7063, AICUZ Program
Cultural/Historic Resources	• AFI 32-7065, Cultural Resources Management • National Historic Preservation Act of 1966, as amended • 36 CFR Part 800—Protection of Historic and Cultural Properties
Air Quality	• NAAQS—40 CFR §81.34 and §81.336 • OAC 3745-17 Particulate Matter Standards • OAC 3745-31 PTI New Source of Pollution • OAC 3745-25 Emergency Episode Standards • OAC 3745-15-06 de minimis air contaminant source exemption
Noise	• 29 CFR 1910.95 Occupational Noise Exposure
Wastewater/Storm Water	• 40 CFR Part 122.26 Storm Water Discharges • OAC 3745-31 Permit to Install New Source of Pollution • OAC 3745-33 Ohio NPDES Permit • OAC 3745-38 NOI • Air Force Technical Order 42C-1-2 (dated 1 October 2003) • City of Fairborn Sewer Use Ordinance • City of Dayton Sewer Use Ordinance (September 21, 1994)

AFI = Air Force Instruction
AICUZ = Air Installation Compatible Use Zone
CWA = Clean Water Act
NAAQS = National Ambient Air Quality Standards
NOI = Notice of Intent
NPDES = National Pollutant Discharge Elimination System
OAC = Ohio Administrative Code
ORC = Ohio Revised Code
OSHA = Occupational Safety and Health Act
PTI = Permit to Install
USC = United States Code

The proposed and alternative action would require permits and/or coordination from various regulatory agencies. The required permits are discussed in detail in Sections 3 and 4 and are summarized in Table 2.

TABLE 2
Summary of Applicable Permits for Proposed Action and Alternative

Potential Environmental Impacts	Applicable Permits/Coordination	Agency
Wetlands/Streams	• CWA, Section 404 Permit	• USACE
	• CWA, Section 401 Permit	• Ohio EPA
Air Quality	• OAC 3745-31 PTI New Source of Pollution	• Ohio EPA
Storm Water	• OAC 3745-33/38 NOI and Subsequent Ohio NPDES Storm Water Construction Permit	• Ohio EPA
Wastewater	• OAC 3745-31 PTI New Source of Pollution	• Ohio EPA
Groundwater	• Coordination regarding wastewater line replacement within the City of Dayton's Mad River well field	• City of Dayton
Traffic	• Coordination with Greene County for improvements to National Road	• Greene County

CWA = Clean Water Act
NOI = Notice of Intent
NPDES = National Pollutant Discharge Elimination System
OAC = Ohio Administrative Code
PTI = Permit to Install
USACE = U.S. Army Corp of Engineers

2.0 Description of Proposed Action and Alternatives

This section describes the proposed action alternatives and the No Action Alternative, and the criteria used to evaluate the potential infrastructure upgrades and new HPW complex construction. The evaluation criteria include design and location or constraints that may affect the degree to which an alternative can meet the project need.

2.1 Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The Proposed Action is to construct new infrastructure, upgrade and/or replace existing infrastructure systems, and construct approximately 700,000 gsf of new facilities for the HPW complex associated with inbound BRAC missions in the Area B Hilltop District of WPAFB. The Proposed Action evaluated in this EA is based on information available in the *Request for Proposal (RFP) 100% Submittal, Facilities Infrastructure Upgrades* (KZF/BWSC, 2007b) and the *35% RFP Design of the HWP Complex Submittal* (KZF/BWSC, 2007a).

The location of the infrastructure upgrades must be in close proximity to the new HPW complex that would be constructed. Infrastructure systems to be upgraded include entry gate, roadways and parking, electrical power, communications, steam and water distribution systems, and sanitary and storm sewers. Although the final design is not complete, infrastructure upgrade requirements have been identified and are further described in Section 2.1.1; the HPW complex design is further described in Section 2.1.2.

Activities associated with the infrastructure upgrades and construction of the HPW facilities would include site mobilization, site preparation, trenching, regrading, and landscaping. Minimal site preparation activities (for example, clearing and grubbing) are anticipated in portions of the project area that are located primarily in open lawn. Extensive site preparation activities are anticipated in the location of the proposed relocated entrance gate. A number of staging areas for construction equipment, vehicles, supplies, work trailers, storage, parking of construction vehicles, etc., would be

needed during the infrastructure upgrade activities and construction of the HPW complex. Possible locations of the staging areas are provided on Figure 2.

Because minor changes may occur during the detailed design of the facilities, the portion of the utilities that tie into each building would not be completed until the facilities are under construction. Where practical, utilities being run underground (for example, buried electric and communication cables) would be collocated in the same trench or conduit to reduce the amount of trenching. Bedrock in the Area B Hilltop District varies considerably, with rock layers lying between 1.3 and 26 feet below ground surface (bgs). Depending on the depth to bedrock, the location of utilities (for example, storm water pipes and steam pipes) may need to be adjusted or the bedrock may require removal to achieve the necessary utility depth.

The infrastructure upgrades are anticipated to begin in fall 2007 and be completed in the spring of 2009. Work on the new gate/entry roadway would be done before other roadway improvements begin. Demolition of Facility 20682 is planned for fall 2007, as is the construction and paving of the new entry road. The improvements on National Road and placement of the entrance gate building are planned for spring 2008. The existing Gate 19B would stay operational until the new entry roadway and guard building have been completed. Access across Q Street would be maintained as long as the existing Gate 19B is in use. Once opened, the new Gate 19B entrance would be used by both normal and construction traffic.

The construction of the new HPW complex is scheduled to begin in spring 2008, with completion by spring 2011. During the HPW complex construction, temporary security fencing would be installed around the construction site. The temporary fencing will block access of 5th Street from Q Street to Hobson Way; Hobson Way from 5th Street to 7th Street; and 1st Street west of Q Street. Construction traffic would continue to use the new Gate 19B entrance until installation of the fencing is complete; a dedicated construction traffic gate would then be opened on Kauffman Avenue into the construction site. The section of Q Street north of 8th Street will be cut off by the construction site fencing. To maintain normal access to this section of Q Street, a temporary

roadway would be installed around the perimeter of the construction site from Hobson Way to Q Street.

Photographs of the Area B Hilltop District are provided in Appendix A. Photographs include views of current site conditions and the locations of the proposed HPW complex and infrastructure upgrades.

2.1.1 Description of the Proposed Infrastructure Upgrades

As discussed in Section 1.4, the infrastructure upgrades would largely be located in the Hilltop District, in the eastern portion of Area B (Figure 1). The infrastructure upgrades that are needed in the Hilltop District include relocation of Gate 19B, roadways, and parking; demolition of Facilities 20682 and 20430; electrical power; communications; water distribution; wastewater (sanitary) system; storm water system; steam system; and natural gas distribution. The following infrastructure upgrade descriptions are based on information available in the *Request for Proposal (RFP) 100% Submittal, Facilities Infrastructure Upgrades* (KZF/BWSC, 2007b) and the *35% RFP Design of the HWP Complex Submittal* (KZF/BWSC, 2007a).

2.1.1.1 Relocation of Gate 19B, Roadways, and Parking

Improvements to roadway capacity and traffic controls would be performed in the Area B Hilltop District to accommodate the increase in personnel associated with the new HPW facilities. These improvements would include relocating and redesigning Gate 19B, widening several roads, adding traffic signals, and adding parking lots (Figure 3). A description of the proposed gate relocation and roadway and parking improvements is provided below.

The proposed relocated entrance gate into Area B would be at the intersection of National Road and Reese Drive and would connect to Hobson Way at 8th Street. The entrance road would be designed in accordance with the current Entry Control Facility Design Guide, with appropriate design speed, traffic control requirements, and active vehicle barriers. The entrance road would include two inbound lanes, with three security/identification check lanes, a guard shack, and an inspection area. These would be designed to ensure sufficient entering capacity. The intersection of National Road

with Reese Drive would be designed to accommodate the new base entrance road. National Road would be widened to the west to provide a southbound right turn lane and northbound left turn lane for turns into the base. The new entrance road would include two lanes departing the base, with three lanes approaching the National Road intersection. National Road improvements would be designed in accordance with the 50 miles per hour operating speed. Additional right-of-way needed for widening National Road would be provided from WPAFB property.

The Hobson Way intersection at 8th Street would be widened to accommodate the new entrance road, with three westbound approach lanes: a separate right lane, a through lane, and a left turn lane. Hobson Way would be widened south of 8th Street to provide three northbound lanes (including separate right and left turn lanes) and two southbound lanes between 8th Street and 10th Street north of 8th Street. 8th Street would be widened to provide a separate eastbound left turn lane. Hobson Way would be widened to include a southbound left turn lane for traffic departing Area B at the new Gate 19B location. A dedicated right turn lane would be constructed along northbound Hobson Way from 8th Street into the southern parking lot of the south HPW facility. This would allow continuous movement of incoming traffic into the facility from 8th Street and the proposed new Gate 19B location. A traffic signal would be installed at the new Hobson Way and 8th Street intersection.

The 5th Street and Hobson Way intersection would be widened to accommodate two northbound approach lanes, including a left turn lane. Hobson Way may need to be widened and realigned on the north side of 5th Street to properly align left turn and through lanes. 10th Street would be widened at the Hobson Way intersection to provide both east and westbound left turn lanes at the Hobson Way intersection. A traffic signal would be installed at the Hobson Way intersection with 13th Street.

Additional roadway upgrades needed to improve the overall operations and safety within the immediate area of the proposed HPW complex include reconstructing the following:

- Hobson Way from the 8th Street intersection to 5th Street intersection as a three-lane road, with the addition of a northbound right turn lane onto 5th Street
- 8th Street from the Hobson Way intersection to Skyline Drive as a two-lane road, with the addition of a left turn lane at Skyline Drive

- 10th Street from the Hobson Way intersection through the Skyline Drive intersection as a two-lane road, with the addition of a left turn lane on both east and westbound approaches at Skyline Drive
- 3rd Street from 5th Street and Hobson Way intersection to Skyline Drive, with existing surface course to be removed and replaced

In addition, roadways in the Area B Hilltop District are in poor condition (for example, cracked pavement). Roadway pavement would be resurfaced or replaced where needed. Potential pavement improvements would include 1st and 5th streets, Hobson Way, Skyline Drive, Q Street, and 13th Street.

Three large parking lots would be constructed for the HPW complex (Figure 2). One parking lot would be located adjacent to and north of the north HPW facility with the entrance to the parking lot from Q Street. A second parking lot would be located adjacent to and south of the south HPW facility; inbound-only access would be from Hobson Way, and there would be access to Q Street. A third parking lot would be located east of the north HPW facility and Q Street; this lot would serve both facilities simultaneously. Numerous walkways would be constructed around the HPW complex which would lead to the parking lots and other existing buildings in the northeast corner of Area B.

To accommodate new parking lots associated with the HPW complex, a portion of Q Street between 5th Street and 10th Street would be replaced with narrow pavement and a portion of the new southern parking lot. A portion of 5th Street between Q Street and National Road would be replaced with narrower pavement and a parking lot.

2.1.1.2 Demolition of Facilities 20682 and 20430

To facilitate the construction of the new gate location on National Road and the construction of the south HPW facility, Facilities 20682 and 20430 would need to be demolished. The locations and layouts of these two facilities are shown on Figure 4.

Facility 20682 is a one-story building located east of Q Street, and south of Facility 20824. The facility lies in the path of the proposed new entrance road into the base. As discussed previously, the proposed new entry road into Area B would be located at the intersection of National Road and Reese Drive and would connect to Hobson Way at 8th Street. The approximately 15,000-square-foot (ft^2) facility was constructed in 1943 as an Enlisted Service Club. The site recently has housed the National Library of Congress (NLC) where movie film maintenance and processing activities were conducted. The NLC is in the process of being relocated to a new facility in northern Virginia. The NLC is scheduled to vacant Facility 20682 in the first quarter of fiscal year (FY) 2008. Facility 20682 is scheduled for demolition shortly thereafter.

Facility 20430 is a one-story facility located in the southeast corner of the intersection of 5th Street and Hobson Way. The northwest corner of the proposed footprint of the south HPW facility would require demolishing Facility 20430. The 5,150 ft^2 facility was constructed in 1944 as the Wright Field Library. Since that time, the building has been used as the Police Headquarters, Academic Lecture Hall, and has housed the Supply Division and the Technical Photo Service Section. In 1986, the building was renovated for use as the Area B Noncommissioned Officers (NCO) Club Annex and currently is used as the Airman Leadership School.

2.1.1.3 Electrical

The facilities associated with the inbound BRAC missions must have an adequate source of electricity. The Dayton Power and Light Company supplies electricity to the base by an overhead, 69-kilovolt (kV) transmission loop via a switching station on Kauffman Avenue. From there, electricity transitions underground to six substations placed throughout Area B (Figure 5). Service to the HPW complex primarily would be from existing Substation A; some service would be supplied by Substation F. Substation A presently has an available capacity of 35 megavolt amperes (MVA), which is adequate to serve the new load requirements of the HPW complex. Local generators would back up essential HPW complex electrical load requirements.

Modifications are required to some overhead lines, underground conduits (ducts), switches, etc. The overhead electrical lines along Hobson Way to 5th Street and east on 5th Street to Q Street would be removed. The 2- to 5-inch duct from the manhole (E449) at the corner of 5th and Q streets would be extended to the manhole (E509) on the south side of 5th Street east of Q Street behind Facility 20837 in the area of the planned Vivarium addition. A smaller duct (1- to 2-inch duct) also would be installed along this route. New four-way circuits would be installed at manhole E509 and manhole E447 (corner of Hobson Way and Monahan Way). A new pad-mounted transformer would be installed near manhole E509 (south side of 5th Street east of Q Street behind Facility 20837). A 1-5-inch conduit would be extended across Monahan Way to the first pole north of 5th Street; a 3-500 cable and new pole-mounted riser would be installed. Circuit breaker B31K would be disconnected from Substation A; a new 1/0 cable would be installed from B31K to a new pad-mounted transformer near Substation A. This source would be used for substation control power.

Modifications to intersections, road widening, and entry gate location would require relocations, additions, and replacements of distribution circuits, overhead lines, community antenna television (CATV) cables, traffic lights, and street lighting. There would be no improvements to the size or capacity of replaced or relocated overhead lines and distributions circuits (that is, components would be replaced “like for like”).

2.1.1.4 Communications

Modifications to intersections, road widening, and the entry gate location would require relocations, additions, and replacements of communications lines. Placement of the lines would be dependent on the final construction designs. Potential upgrades to the communications systems (telephone, data, low-voltage cables) include installing a new communication cable termination room, both south of 5th Street between P and Q streets, in the south HPW facility. New duct banks would be routed from the intersection of 5th Street and Skyline Drive to the south HPW facility. New manholes would be designed and constructed along the duct routing on the north side of 5th Street. A new duct bank would be routed north to serve Facility 20676 from the existing communications line.

New duct banks would be designed and constructed with six 5-inch polyvinyl chloride (PVC) conduits along 5th Street to Hobson Way then with four 5-inch PVC conduits to Q Street. Spare conduits in the existing duct banks would be used to run cables for proposed communications systems (telephone, data, CATV, low-voltage cables) for the new buildings (KZF/BWSC, 2007b).

2.1.1.5 Water Distribution

Water lines serving the proposed HPW complex would be installed around the perimeter of both the north and south buildings. Each system would have an 8-inch water main with fire hydrants and two separate water lateral (from opposite directions) consisting of an 8-inch fire service line and a 4-inch domestic service (Figure 6). Water lines serving the proposed Vivarium addition behind Facility 20838 also would be installed. Prior to any water main installation, a plans approval permit must be approved by the Ohio Environmental Protection Agency (Ohio EPA).

2.1.1.6 Wastewater (Sanitary) System

Based on a preliminary evaluation of sanitary flow demand in the project area, data indicate there is not enough capacity in the existing sanitary "L" and "M" lines for the HPW complex and other future construction projects in the immediate or adjacent project area. The "L" line is the wastewater collection system that carries wastewater from the Hilltop District to the City of Dayton Wastewater Treatment Plant (WWTP). Some of the existing pipe provides the capacity to handle additional flow from the proposed HPW complex; however, the pipes would be more than half full and therefore unable to provide sufficient capacity for future growth. To ensure that the sanitary pipes remain half full or less, more pipes would need to be installed (KZF/BWSC, 2007b). Pipes with inadequate capacity to handle the additional sanitary loads would be replaced. The proposed wastewater system upgrades are presented on Figure 7.

For the "M" line, upgrades would include replacing sanitary sewer lines near the Sensors Directorate area along Hobson Way between 10th and 13th streets and in the Area B downtown area. For the "L" line, upgrades would consist of installing 6-inch sanitary pipe service laterals for both HPW complex buildings; installing a new 10-inch sanitary line connecting manholes L91 to L85; replacing existing 8-inch piping with 10-inch piping between manholes L27 and L26; and rerouting the "L"

line around the proposed detention basin between existing manholes L26 and L23 with new 10-inch piping. Prior to any sanitary main installation, Ohio EPA must approve a permit to install (PTI) (KZF/BWSC, 2007b).

2.1.1.7 Storm Water System

Storm water flow on base is dependent on actual site conditions such as incorporating green space to reduce or detain storm water flow and minimize paved areas. The Area B Hilltop District is generally drained by open ditches with little piping (Figure 8). Currently, the existing storm water runoff volume is estimated at 70 cubic feet (ft^3) per second. With the proposed construction of the HPW complex, 70 percent of the area would have impervious surfaces (that is, ground surface would be covered by buildings, walks, and parking lots), and the estimated storm water runoff volume would potentially increase to 210 ft^3 per second, which would require the construction of new storm sewer lines. No combined storm and sanitary sewers would be constructed.

In the location of the proposed HPW complex north of 5th Street, there are two open drainages that drain the site and surrounding sites. Both open drainages flow northward toward and under 1st Street and into a ditch north of the intersection of Kauffman Avenue and Q Street that goes along the west end of an existing coal plant. A partial roadway ditch that has a few existing culverts runs along Q Street and also empties into the ditch north of Kauffman Avenue. The open drainage in the western portion of the area lies within the footprint of the north HPW facility. This open drainage would be moved further west outside of the building footprint and enclosed in pipe; the pipeline would run east of Hunter's Lodge, existing trees, and the steep western hillside. The pipe would connect to the existing 48-inch corrugated metal pipe (CMP) culvert under 1st Street. The storm lines from west of Hobson Way, south of 5th Street, and the Information Technology Center (ITC) would be tied into the storm run.

Revised pipe would replace the second open drainage and the existing roadway ditch and would have inlets for roadway runoff. Existing storm piping on the west side of Q Street would be replaced and/or modified. The revised piping would run down Q Street and 1st Street to an area near the

intersection of 1st Street and the maintenance drive, and would tie into twin 24-inch reinforced concrete pipe (RCP) culverts. Piping from the HPW complex and area east of Q Street would be tied into this storm run. The area north of 5th Street has a lot of subsurface water flow that has been observed in many underground structures (manholes, hand holes, piping, tunnels, trenches, etc.). To handle subsurface water flow north of 5th Street, KZF/BWSC (2007b) recommends installing a system of perforated piping that would be tied into the storm sewer system.

In the vicinity of the proposed HPW complex south of 5th Street and in the area of the ITC, roadway ditches such as those west of Q Street and on the east side of Hobson Way would be replaced with storm piping and have inlets for roadway runoff. When implementing upgrades, the existing storm lines would be used as much as possible. The existing 24-inch storm line under 5th Street would be reused. Small related upstream storm lines may need to be replaced.

The placement of underground pipes depends on the depth of bedrock in the Area B Hilltop District. If bedrock is close to the surface in a given area, the proposed placement of pipes may change.

WPAFB currently has a policy that water bodies should not be created that could attract birds within the flight path of the base. Because of the significant increase in storm water runoff as a result of the proposed construction of the facilities associated with the inbound BRAC missions, a detention basin would be created on the north side of 1st Street near Maintenance Facility 20745. A dry detention basin is a structure that would hold water from a storm and release the water to a specific outfall point over a specific period of time. A detention basin primarily is used to reduce peak storm water discharge and prevent flooding.

The basin would be located north of 1st Street in an existing maintenance yard area (Figure 8). Preliminary storm water runoff detention calculations (KZF/BWSC, 2007b) indicate that the basin would be required to hold a minimum of 215,000 ft^3 (equivalent to 4.92 acre-feet) of water for a 100-year storm. The proposed detention basin would be approximately 232 feet by 232 feet by 4 feet

deep; it would be grass covered with 4:1 maximum side slopes and a minimum 2 percent bottom invert slope to facilitate complete drainage.

To reduce the likelihood of being an attractant to wildlife, the detention basin would be designed to empty within 48 hours and would remain dry between rainfalls. Because of the presence of shallow subsurface water in the area, the basin invert would be a concrete flume and/or subsurface drainage piping to keep the bottom of the basin dry to prevent vegetation growth that may provide a nesting habitat. The speed of the storm water runoff would be reduced prior to reaching the detention basin by using such methods as grassed swales, level spreaders, rock-lined channels, diversions, or subsurface drainage. Storm water release from the detention basin would most likely be to Outfall Number 005. Although remote, there is a possibility that a new outfall could be created for discharge from the detention basin. The detention basin design will be finalized during the MILCON process.

2.1.1.8 Steam System

Area B is heated by a central steam system; the service is provided by three Central Plant (Facility 20770) coal-fired boilers (winter operation) and two gas-fired boilers (summer operation). Two of the coal-fired boilers currently serve the normal demand load and one provides back-up service as required. Distribution from the steam plant is provided through three steam system mains; lines "A" and "B" (both 12-inch mains) serve "uptown" Area B (between Skyline Drive and National Road). Currently, portions of the steam lines in the Hilltop District are located above ground. These lines would be relocated, generally following existing roadways, and installed, along with new lines, in shallow trenches (Figure 9). As shown on Figure 9, a large portion of the aboveground steam line extending toward 5th Street in the proposed location of the HPW complex would be relocated to the east and placed in new shallow trench systems to accommodate parking lot areas and the new buildings. New steam and condensate mains would be extended from existing "A" line mains to the new buildings.

Aboveground mains extending from the steam tunnels east of Facility 20770 also would be placed in a shallow trench system. The steam lines in the location of the proposed dry detention basin would

be relocated to the west. As mentioned previously, the depth to bedrock in Area B varies widely; if bedrock is close to the surface in a given area, the proposed placement of pipes may change or bedrock removal to the required utility depth would be necessary.

No new steam generating plants or upgrades of existing plants would be constructed.

2.1.1.9 Natural Gas

There is natural gas available for the proposed project area (KZF/BWSC, 2007b). For special gas loads, it may be necessary to increase the pressure coming onto the base. Meter or gas pressure changes would occur at the existing gas meter on National Road near the southeast corner of Facility 20441. Utility service laterals for each facility would be needed for each building. North of 5th Street, the HPW complex would need piping to the building from the existing 3-inch main that runs along the east and west sides of Q Street. South of 5th Street, the HPW complex would need piping to the building from the existing 2-inch/3-inch main that runs along the east side of Q Street.

2.1.2 Description of the Proposed HPW Complex

The HPW complex would consist of approximately 700,000 gsf of new facilities in the Hilltop District. The HPW complex would be comprised of two facilities: the north HPW facility is to be located on the north side of 5th Street between Hobson Way/3rd Street and Q Street; the south HPW facility is to be located south of 5th Street between Hobson Way and Q Street, with 8th Street to the south. The footprints of the proposed new facilities are presented on Figure 2. The proposed architecture in the *35% RFP Design of the HPW Complex* (KZF/BWSC, 2007a) for the new facilities would be a maximum of four stories with precast, brick and glass banding. It is anticipated that the building foundations for the new facilities in the Hilltop District would range from 8 to 13 feet below grade.

2.1.2.1 North HPW Facility

The north HPW facility would consist of three building "modules" which provide multiple discrete service areas and access to daylight (Figure 2). The functions in the north HPW facility would be industrial in nature and have high security requirements; the primary occupants would be a portion

of AFRL/HE (north building module/three stories), NAMRL (middle building module/single story), and a portion of USAFSAM (southern module/single story). The modules would be connected by a circulation spline; they would be arranged parallel to exiting sloping grades at the site to minimize rock cutting and importing of fill material. The middle module would be a single story for NAMRL, and the southern module would contain a portion of USAFSAM. The service yard, located between the north and middle modules would contain the major cooling towers, transformers, and an emergency generator. The main entrance lobby from the HPW quadrangle (central plaza) between the north and south HPW facilities would be located in the southernmost module.

2.1.2.2 South HPW Facility

The south HPW facility would house the majority of laboratory space, as well as most of the teaching and administrative spaces; the primary occupants will by USAFSAM, AFRL HE, and AFIOH. The four-story building would be organized as a series of bars along a simple circulation spine, with office and laboratory spaced layered along the spine.

2.2 Alternative 2—No Action Alternative

Under the No Action Alternative, it is assumed that infrastructure upgrades and construction of the HPW complex would not be completed. This alternative will serve as a baseline against which the Proposed Action can be compared.

2.3 Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Under this alternative, the infrastructure upgrades described above would be phased to coordinate with the construction of each facility associated with the inbound BRAC missions instead of as a single overall effort. For instance, the infrastructure upgrades needed in the vicinity of the north and south buildings of the HPW complex would begin when construction of each building is initiated, which would be determined during the detailed design of each HPW facility some time after April 2008. Each component listed under the Proposed Action would be included in this alternative, but the sequence and duration of the project activities would be different than the Proposed Action. This alternative could potentially increase the cost and length of time to complete the infrastructure

upgrades by segmenting the project. This alternative also could result in a greater number of project activities occurring in parallel, creating the potential for larger areas of exposed soil.

2.4 Alternatives Eliminated from Further Study

USAF designed the alternatives listed above as reasonable alternatives to be considered for evaluation. During the planning, several other alternatives were considered.

2.4.1 Roadway Alternatives

Several alternatives to the Gate 19B issue were developed and analyzed; however, the engineering analysis showed that only one, the Reese Drive alternative as proposed, was feasible for both traffic and antiterrorism and force protection (AT/FP) perspectives.

An alternative initially considered as part of the roadway improvements was the extension of 5th Street through the parking area east of K Street, which would connect to 5th Street at Skyline Drive. This alternative would improve the connectivity of arterials in Hilltop District and the Downtown District, allow improved access to the Hilltop District from Gate 1B, and thereby possibly reduce the traffic backups at Gate 19B. Because of potential impacts to the historical Officers Recreation Area, located between L Street and Skyline Drive, and the steep grade between K Street and Skyline Drive, this alternative was eliminated from further evaluation.

Improvement of the existing Gate 19B at its current location also was considered and then eliminated from further evaluation. Improvement of the gate included widening National Road to accommodate south and north turn lanes into this gate. This option was eliminated because Gate 19B cannot be modified to absorb the projected increased traffic. The buildings along 5th Street are too close to allow widening of the road while maintaining proper standoff distances. In addition, the distance between Q Street and National Road is inadequate to install a final denial barrier to meet AT/FP requirements and provide adequate queuing distance. Moving the gate farther from National Road to increase the queuing capacity is not feasible; Q Street cannot be closed at this location due to the need for access north of 5th Street.

A third option considered was relocating Gate 19B to Kauffman Avenue, in the vicinity of the old Gate 16B. This option was eliminated for several reasons. First, a gate located on Kauffman Avenue would direct traffic onto Skyline Drive at the northern end of the Hilltop District. It would not evenly distribute traffic to the various Area B Hilltop District facilities, and the concentrated traffic volumes would require extensive amounts of road widening to distribute traffic through the area. Second, traffic primarily originates south of the base. A gate off of Kaufman Avenue would be a longer distance for drivers and would discourage its use; as a result, more traffic would concentrate at Gate 22B. Third, the uphill grade at this gate would be a problem during inclement weather, with start and stop traffic. Fourth, a gate at this location would introduce a new signalized intersection along Kauffman Avenue. There is only 1,800 feet between the National Road and State Route (SR) 444 intersections. Introducing a new signalized gate along that stretch of road would not meet the Ohio Department of Transportation (ODOT) design requirements for 1,300 feet spacing between traffic signals, as there would only be 900 feet spacing if a signal was added between these intersections. Furthermore, an additional traffic signal on Kauffman Avenue would only increase traffic congestion on that road and lead to traffic backups onto SR 444 and into the National Road intersection.

Two options were considered for relocating Gate 19B along National Road and modifying internal road connections to the new gate location. One included an extension of 8th Street due east to National Road, and relocation of the gate at that intersection. This alternative was eliminated because it would place a second intersection along National Road only 600 feet from the intersection at Reese Drive. This arrangement would limit the options for improvements to National Road. Notably, a northbound left turn lane to the new gate location would be limited in length by the existing southbound left turn lane to Reese Drive. In addition, this alternative would place two signalized intersections 600 feet apart, considerably less than the ODOT signalized intersection spacing requirements. To avoid the intersection spacing conflict, a second option was developed to relocate the gate to the Reese Drive intersection and connecting to an extension of 10th Street. This alternative was eliminated because the extension of 10th Street would require relocation of an existing water tower at the corner of 10th and Q streets.

The Proposed Action is a hybrid of the last two options, connecting an extension of 8th Street to a relocated Gate 19B at the Reese Drive intersection. This alternative was found to accommodate the needed capacity and security requirements, allow for useful modifications along National Road, avoid signalized intersections in close proximity, and provide good traffic circulation within Area B. Redesign of the gate also will improve the accessibility of the gate to traffic originating from the south.

2.4.2 Steam System Alternatives

Several options were considered to increase the capacity of the stream generation plants in Area B to serve the new facilities. These options included upgrading the capacity of the existing coal-fired boiler system; adding a coal-fired boiler to the existing steam plant in Facility 20770; constructing a separate natural gas-fired central heating plant near the new HPW complex; or providing individual natural gas-fired heating plants in each new building. Ultimately, these options were eliminated because of cost, and the fact that the existing coal-fired steam generation plants were found to have adequate capacity to serve the proposed facilities. Furthermore, existing gas-fired boilers can provide additional peak capacity during cold periods. Consequently, no upgrades to the steam generation plants are proposed.

2.5 Selection Criteria for Screening of Alternatives

Although the BRAC process drove the decision to move missions to WPAFB, the decision as to where to place these inbound missions went through a careful siting process. The criteria used to determine potential sites were grounded primarily in the mission objectives, with secondary objectives of minimizing environmental impacts, reducing other impacts to the existing population, such as not increasing traffic congestion, and maximizing synergies with respect to optimal utility placement, given the quantity of construction expected. These project objectives are spelled out in more detail below. These objectives were then used to identify reasonable alternatives, including the Proposed Action. The Hilltop District Area B project area was the only site that met the objectives stated below.

The operational criteria used to evaluate the potential site for the HPW complex centered on three types of decision criteria. Operational criteria are important to design and location, or are construction features that affect the degree to which the Proposed Action can meet project needs and objective selection of the site location for the HPW complex.

2.5.1 Using Organization Mission Requirements

The Cost of Base Realignment Actions (COBRA) model BRAC facilities program was the starting point for understanding the types of facilities the future users would need at WPAFB. The Area B Hilltop District became the preferred location based on the large projected scope, logical functional relationships to existing AFRL/HE facilities that will also be a part of HPW, and adequate developable land; that is, minimal environmental or operational prohibitions. The model of the new HPW is the "iron triangle," which is comprised of education, research, and clinical elements. The new HPW is intended to combine many of the related and interwoven functions and capabilities into one campus setting. The intention is to create an atmosphere of collaboration and possible cross-pollination of ideas, processes, and methods. The missions making up the HPW complex are estimated to increase the base work force by approximately 1,200 persons. In addition, there are approximately 150 pipeline students estimated annually as well as various transient students and visitors. To accommodate this influx of new military and civilian staff, it was determined that 30 to 40 acres would be needed for the approximate 700,000 gsf of office space and laboratories associated with the new HPW complex.

2.5.2 WPAFB Planning Requirements

The WPAFB General Plan (Woolpert, 2001) and the Integrated Natural Resources Management Plan (INRMP) (WPAFB, 2007a) were the primary sources for providing operational and natural, cultural, and environmental constraints; operational synergies; infrastructure capacity; compatible land use availability; and potential impact to current capital improvements plans. The site selected for the HPW complex was chosen because it represented the optimal mix of infrastructure capacity, lack of environmental constraints, and operational synergies. The only environmental constraint identified during the site selection process was an archaeological resource site, the prehistoric Adena burial

mound located along Hobson Way (Figure 6). No safety constraints were identified during the site selection process.

2.5.3 Applicable Substantive Environmental Laws or Regulations

The WPAFB General Plan (Woolpert, 2001) and INRMP (WPAFB, 2007a) provided known WPAFB areas where development would be prohibited or tightly regulated. This allowed the base to quickly evaluate potential sites and determine the Hilltop District area bounded by 10th Street (south); Q Street (east); Hobson Way, 3rd Street, and Skyline Drive (west); and 1st Street (north) as the proposed site location.

2.6 Comparison of Environmental Consequences between Alternatives

The impacts associated with the Proposed Action and the alternatives are summarized in Table 3. The information includes a concise definition of the issues addressed under each alternative and the environmental impacts associated with each alternative. The analysis is based on information discussed in detail in Section 4.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Natural Resources			
Vegetation	Short-term: Minor, negative impacts during site preparation/excavation activities due to temporary loss of vegetation cover on project areas.	Short-term: No impact.	Short-term: Minor, negative impacts during site preparation/excavation activities due to temporary loss of vegetation cover on project areas.
	Long-term: Nominal impact from loss of vegetation on project area; vegetation is common and site would be revegetated and landscaped.	Long-term: No impact.	Long-term: Nominal impact from loss of vegetation on project area; vegetation is common and site would be revegetated and landscaped.
Wildlife	Short-term: Minor habitat loss. No unusual or high quality habitats will be affected.	Short-term: No impact.	Short-term: Minor habitat loss. No unusual or high quality habitats will be affected.
	Long-term: Minor habitat loss. No unusual or high quality habitats will be affected.	Long-term: No impact.	Long-term: Minor habitat loss. No unusual or high quality habitats will be affected.
Threatened and Endangered Species	Short-term: Tree cutting to be performed in accordance with INRMP to avoid potential impacts to Indiana bat.	Short-term: No impact.	Short-term: Tree cutting to be performed in accordance with INRMP to avoid potential impacts to Indiana bat.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Wetlands	Short-term: Minor loss (0.06 acre) at new gate location. Mitigation to be performed in accordance with Section 404/401 permits.	Short-term: No impact.	Short-term: Minor loss (0.06 acre) at new gate location. Mitigation to be performed in accordance with Section 404/401 permits.
	Long-term: No impact. No net loss with mitigation per Section 404/401 permits.	Long-term: No impact.	Long-term: No impact. No net loss with mitigation per Section 404/401 permits.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Water Resources			
Groundwater	Short-term: No impact.	Short-term: No impact.	Short-term: No impact.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Surface Water	Short-term: Potential minor impacts during site preparation/excavation. Impacts would be minimized because erosion and siltation controls would be implemented.	Short-term: No impact.	Short-term: Potential minor impacts during site preparation/excavation. Impacts would be minimized because erosion and siltation controls would be implemented.
	Long-term: Minor loss of open drainage habitats. Mitigation according to Section 404/401 permits. Potential three-fold increase in storm water runoff; impacts minimized by installing detention basin.	Long-term: No impact.	Long-term: Minor loss of open drainage habitats. Mitigation according to Section 404/401 permits. Potential three-fold increase in storm water runoff; impacts minimized by installing detention basin.
Floodplain Issues	Short-term: No impact.	Short-term: No impact.	Short-term: No impact.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Hazardous Materials/Waste, Stored Fuels, and Installation Restoration Program (IRP)			
Hazardous Materials/Waste	Short-term: No impact.	Short-term: No impact.	Short-term: No impact.
	Long-term: Potential minor impact to HAZMAT purchase/usage/storage and increase in HW generation. Impacts will be minimized by adding more HAZMAT contractor support personnel and constructing new waste storage facility.	Long-term: No impact.	Long-term: Potential minor impact to HAZMAT purchase/usage/storage and increase in HW generation. Impacts will be minimized by adding more HAZMAT contractor support personnel and constructing new waste storage facility.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Stored Fuels	Short-term: No impact.	Short-term: No impact.	Short-term: No impact.
	Long-term: Three new emergency generators with fuel tanks will be installed. Potential minor impacts minimized by requiring secondary containment and compliance with SPCC Plan.	Long-term: No impact.	Long-term: Three new emergency generators with fuel tanks will be installed. Potential minor impacts minimized by requiring secondary containment and compliance with SPCC Plan.
IRP Sites	Short-term: Potential minor impacts associated with resurfacing or replacing roadways. Digging and soil disturbances are allowable in the IRP-impacted sites with approval from Base Civil Engineering and Environmental Management Division personnel.	Short-term: No impact.	Short-term: Potential minor impacts associated with resurfacing or replacing roadways. Digging and soil disturbances are allowable in the IRP-impacted sites with approval from Base Civil Engineering and Environmental Management Division personnel.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Land Use	Short-term: Minor impacts to the parcourse in the recreational area near proposed relocation site of entrance gate. The new road would cut through the parcourse, requiring it to be redirected. Aesthetically, minor impacts to the park-like setting of this recreational area. Land use designation in the location of the HPW complex would change from open space to research and development. Impacts would be nominal because the land use change would be consistent with the WPAFB General Plan.	Short-term: No impact.	Short-term: Minor impacts to the parourse in the recreational area near proposed relocation site of entrance gate. The new road would cut through the parcourse, requiring it to be redirected. Aesthetically, minor impacts to the park-like setting of this recreational area. Land use designation in the location of the HPW complex would change from open space to research and development. Impacts would be nominal because the land use change would be consistent with the WPAFB General Plan.
	Long-term: Same as those described for short-term impacts.	Long-term: No impact.	Long-term: Same as those described for short-term impacts.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Geology and Soil	Short-term: Potential minor impacts (i.e., soil erosion) during site preparation/excavation activities. Impacts would be minimized because erosion and siltation controls would be implemented.	Short-term: No impact.	Short-term: Potential minor impacts (i.e., soil erosion) during site preparation/excavation activities. Impacts would be minimized because erosion and siltation controls would be implemented.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Cultural/Historic Resources	Short-term: Construction disturbance in Wright Field Historic District. No impacts on NRHP-eligible resources.	Short-Term: No impact.	Short-term: Construction disturbance in Wright Field Historic District. No impacts on NRHP-eligible resources.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Air Quality	Short-term: Impact from particulate matter and engine exhaust emissions generated during site preparation/excavation, resurfacing, and detention basin construction activities. Area of disturbance associated with infrastructure and HPW complex construction and impacts from particulate matter will have to be managed to maintain compliance with the existing Title V permit.	Short-term: No impact.	Short-term: Impact from particulate matter and engine exhaust emissions generated during site preparation/excavation, resurfacing, and detention basin construction activities. Area of disturbance associated with infrastructure and HPW complex construction and impacts from particulate matter will be greater than those described for Alternative 1 and will have to be managed to maintain compliance with the existing Title V permit.
	Long-term: Minor increase in air emissions from Facility 20770 resulting from increased steam load to HPW complex. Air permit limits not exceeded.	Long-term: No impact.	Long-term: Minor increase in air emissions from Facility 20770 resulting from increased steam load to HPW complex. Air permit limits not exceeded.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Noise	Short-term: Minor impacts on ambient noise from site preparation, excavation, and construction activities. Impacts would be minor because these activities would be carried out during normal working hours.	Short-term: No impact.	Short-term: Minor impacts on ambient noise from site preparation, excavation, and construction activities. Impacts would be minor because these activities would be carried out during normal working hours.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Health and Safety	Short-term: Potential impacts to workers during construction activities. Impacts would be minimized by adherence to safety standards.	Short-term: No impact.	Short-term: Potential impacts to workers during construction activities. Impacts would be minimized by adherence to safety standards.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.
Socioeconomics	Short-term: Beneficial impact on local economy from construction-related employment, goods and services.	Short-term: No impact.	Short-term: Beneficial impact on local economy from construction-related employment, goods and services.
	Long-term: Beneficial impact on local economy once the HPW complex is operational.	Long-term: No impact.	Long-term: Beneficial impact on local economy once the HPW complex is operational.
Transportation/Traffic	Short-term: Intermittent roadway closures in project area during construction; impact to local traffic at Gate 19B from additional construction vehicles.	Short-term: No impact.	Short-term: Intermittent roadway closures in project area during construction; impact to local traffic at Gate 19B from additional construction vehicles.
	Long-term: Beneficial impact from improved primary arterial capacity/circulation in Area B and pavement improvements.	Long-term: No impact.	Long-term: Beneficial impact from improved primary arterial capacity/circulation in Area B and pavement improvements.

TABLE 3
Comparison of Environmental Consequences of the Proposed Action and Alternatives

Resources	Alternative 1—Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)	Alternative 2—No Action	Alternative 3—Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed
Utilities	Short-term: Possible intermittent outages at existing facilities during construction. Impacts to existing lines not targeted for replacement would be minimized by verifying their locations in advance and following standard operating procedures	Short-term: No impact.	Short-term: Possible intermittent outages at existing facilities during construction. Impacts to existing lines not targeted for replacement would be minimized by verifying their locations in advance and following standard operating procedures
	Long-term: Improved utility capacity, service lines, and redundancy in the project area. Proposed improvements would not exceed the existing capacities of the utility services.	Long-term: No impact.	Long-term: Improved utility capacity, service lines, and redundancy in the project area. Proposed improvements would not exceed the existing capacities of the utility services.
Environmental Justice	Short-term: No impact.	Short-term: No impact.	Short-term: No impact.
	Long-term: No impact.	Long-term: No impact.	Long-term: No impact.

3.0 Affected Environment

3.1 Introduction

This section identifies existing environmental conditions at WPAFB that could be affected by the Proposed Action and alternatives including natural resources, water resources, HAZMAT and HW, stored fuels, IRP, land use, soils, cultural resources, air quality, noise, health and safety, socioeconomics, transportation and traffic, utilities, and environmental justice.

3.2 Natural Resources

3.2.1 Vegetation

The proposed location for the construction of the BRAC infrastructure upgrades and HPW complex in the Area B Hilltop District consists of areas designated by the base as a previously disturbed area currently maintained as lawns. Vegetation in this area consists primarily of planted grasses, with few invasive broad-leaf plants (Appendix A). Dominant species include tall fescue (*Festuca arundinacea*), Kentucky bluegrass (*Poa pratensis*), dandelion (*Taraxacum officinale*), and clover (*Trifolium pratense* and *T. repens*) (WPAFB, 2007a). Ornamental, hardwood, and evergreen tree species also are scattered throughout the site, such as dogwoods (*Cornus* spp.), oaks (*Quercus* spp.), firs (*Abies* spp.), and maples (*Acer* spp.).

3.2.2 Wildlife

Wildlife surveys conducted at WPAFB (BHE Environmental, Inc. [BHE], 1999a) documented the presence of 23 mammals, 99 birds, and 7 reptiles (3 snakes and 4 turtles). Common mammals on base include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), beaver (*Castor canadensis*), groundhog (*Marmota monax*), eastern fox squirrel (*Sciurus niger*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and deer mouse (*Peromyscus maniculata*). Common birds on base include European starling (*Sturnus vulgarus*), eastern meadowlark (*Sturnella magna*), barn swallow (*Hirundo rustica*), Savannah sparrow (*Passerculus sandwichensis*), red-winged blackbird (*Agelaius phoeniceus*), Canada goose (*Branta canadensis*), red-tailed hawk (*Buteo jamaicensis*), horned lark (*Eremophila alpestris*), American robin (*Turdus migratorius*), turkey vulture (*Cathartes aura*), mourning dove

(*Zenaida macroura*), killdeer (*Charadrius vociferus*), American crow (*Corvus brachyrhynchos*), and mallard (*Anas platyrhynchos*).

According to the sitewide characterization report (International Consultants Incorporated [ICI] and Science Applications International Corporation [SAIC], 1995), resident mammals commonly found in disturbed areas of the base, such as the proposed location of the infrastructure upgrades and HPW complex, include eastern cottontail rabbit (*Sylvilagus floridanus*), chipmunk, opossum, and gray squirrel. Birds, such as pigeon (*Columba leucocephala*), killdeer, English sparrow (*Passer domesticus*), mockingbird (*Mimus polyglottos*), and red-winged blackbird also are often observed within disturbed areas, such as the proposed location of the infrastructure upgrades and HPW complex.

3.2.3 Threatened and Endangered Species

Compliance with Air Force Policy Directive (AFPD) 32-70 and Air Force Instruction (AFI) 32-7064 requires all USAF installations to protect species classified as endangered or threatened under the Endangered Species Act of 1973 (ESA) and to comply with Ohio Revised Code (ORC) 1531.25 and its implementing regulations for species listed by the state as threatened and endangered. To comply with these requirements, WPAFB developed an Endangered Species Management Plan (BHE, 2001), which has been incorporated into the INRMP (WPAFB, 2007a). Federal- and/or state-listed species at WPAFB include the Indiana bat (*Myotis sodalis*), bald eagle (*Haliaeetus leucocephalus*), eastern massasauga rattlesnake (*Sistrurus c. catenatus*), clubshell (*Pleurobema clava*, a mussel), and blazing star stem borer (*Papaipema beeriana*, a moth).

Indiana bat habitat follows the lower reaches of Hebble Creek, Trout Creek, and the riparian corridor of Mad River from its northern reach in Area A to its confluence with Hebble Creek (ICI/SAIC, 1995; BHE/IT Corporation, 1999). During the late spring and summer months, this species migrates from its winter hibernacula (typical caves or old mines) and roosts under loose bark and in cavities of living or dead trees. Typically, this species forages in riparian and floodplain forests or along forest edges. In July 2000, two Indiana bats (a juvenile female and an adult post-lactating female) were captured along Trout Creek during a basewide mist net survey (BHE, 2001). Radio tracking of

these two bats confirmed the presence of a maternity colony in a dead slippery elm (*Ulmus rubra*) in a woodlot on the campus of Wright State University. Recent mist net studies were conducted in July 2007 (AMEC Earth and Environmental, July 2007, unpublished). This survey included a number of netting sites surrounding the project area, both in Area B to the south and east of the project area, and to the north in Area C. The only Indiana bats identified in these surveys were in Area C, along the Mad River, 1.7 miles or more from the project area.

The area of the relocated gate is in a wooded area, which includes trails and mowed park-like setting. Several potential roost trees (shagbark hickories) were identified within the area (Figure 10) during a site visit conducted by CH2M HILL on July 27, 2007. This area was not identified as suitable habitat on either of the previous Indiana bat surveys. Given that no Indiana bats have been found nearby in the mist netting surveys of 2000 or 2007, this area is considered to have low habitat potential.

The bald eagle recently was removed from the federal list of threatened and endangered species, although it is still a state-listed species. This species is typically found along waterways and impoundments. Although bald eagles may be found year round in Ohio, they only occur on WPAFB as rare winter visitors with most previous sightings having been along the Mad River corridor, which contains potentially suitable winter foraging and roosting habitat (WPAFB, 2007a). No sightings of the bald eagle have been reported within the project area.

The eastern massasauga rattlesnake is a federal candidate species usually found in wet areas including wet prairies, marshes, and low-lying areas. Neither the historical nor current population status of the massasauga rattlesnake at WPAFB has been determined. Reports of massasauga rattlesnake sightings have been limited to the Prime BEEF Training Area and Twin Base Golf Course, which are not in the vicinity of the project area. Because the massasauga rattlesnake is a federal candidate species, there is no requirement to survey construction areas for potential snake habitat. No sightings of the massasauga rattlesnake have been reported within the project area or any part of Area B.

The clubshell is a federal- and state-listed endangered species occurring in 12 streams in Kentucky, Pennsylvania, Indiana, Ohio, Michigan, and West Virginia. During recent surveys by 3D/International, Inc. (1998) and BHE Environmental (1999a), subfossil remains of the clubshell were documented at the confluence of Trout Creek and Mad River and near the confluence of Mud Run and Mad River (WPAFB, 2007a). Water bodies identified within the project area do not provide suitable habitat to support a population of clubshell mussels. In addition, no sightings of the clubshell have been reported within the project area.

The blazing star stem borer is a state-listed endangered species occurring only in disjunct populations throughout the Midwestern United States. It is highly dependent upon remnants of mesic tall grass prairies. In 1992, three stem borers were captured at WPAFB's Huffman Prairie. Huffman Prairie is one of three locations where this species has been found in Ohio (WPAFB, 2007a). Habitat within the project area is not suitable to sustain a population of the blazing star stem borer. In addition, no sightings of the blazing star stem borer have been reported within the project area.

The upland sandpiper is a state-listed threatened species normally found in upland habitat. It has been found nesting near the base Aero Club in Area C (ICI/SAIC, 1995). No sightings of the upland sandpiper have been reported within the project area.

Copies of correspondence with the Ohio Department of Natural Resources (ODNR) and the U.S. Fish and Wildlife Service (USFWS) regarding the potential occurrences of threatened and endangered species in the project areas are provided in Appendices B and C, respectively. As indicated by ODNR, the pigeon grape (*Vitis cinerea*, a high climbing vine) is located within the southeastern portion of Area B Hilltop District adjacent to the proposed project area (Appendix B). This species is designated as potentially threatened in Ohio. ODNR did not identify the massasauga rattlesnake within the project area. USFWS confirmed that the WPAFB area lies within the range of the federal-listed Indiana bat, eastern massasauga rattlesnake, clubshell mussel, and bald eagle. USFWS states that, because of the lack of suitable habitat within the infrastructure upgrades and HPW complex project area, no impacts to the bald eagle and clubshell mussel are anticipated.

Based on records of these species at WPAFB, the USFWS letter states that the project may affect either the Indiana bat or the eastern massasauga rattlesnake, and encourages project coordination to avoid impacts to habitats suitable for these species. It is important to note that the USFWS letter was responding to a single request to address all parts of the proposed BRAC missions, including activities planned for Area C, where the eastern massasauga rattlesnake and Indiana bat have been found. Neither of these species has been recorded in the project area. Guidelines to avoid adverse effects to the Indiana bat, as provided by USFWS, are provided in Appendix C and stipulate that trees and associated habitats meeting species requirements be saved whenever possible.

3.2.4 Wetlands

According to recent guidance from the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) (2007), wetlands that have a significant nexus to traditionally navigable waters are regulated under Sections 401 and 404 of the Clean Water Act (CWA). A significant nexus must meet a number of criteria that indicates the wetland provides biological, physical, or chemical benefits to the navigable water. Typically, a significant nexus requires a surface water connection to the navigable waters or a relatively permanent tributary. Impacts to these wetlands must be permitted by USACE and possibly also the Ohio EPA (see also Section 3.3.2).

All wetlands, regardless of their surface connections, are regulated pursuant to Executive Order (EO) 11990, Protection of Wetlands. This EO requires consideration of alternatives that do not impact wetlands and mitigation for any unavoidable wetland impacts.

A wetland delineation was conducted on WPAFB in 2004 (BHE, 2005). In Areas B and C, 44 wetlands covering approximately 20.5 acres were identified and delineated. Area B contains 17 wetlands comprising 2.51 acres of palustrine wetlands: forested or open water wetlands (0.99 acre), forested wetlands (0.04 acre), scrub/shrub wetlands (0.14 acre), and emergent wetlands (1.34 acres). Of the wetlands within Area B, several (B10, B1, B2, B3, B5, B7, B11, and B12) were identified adjacent to areas designated for the infrastructure upgrades and HPW complex (Figure 11).

Three wetlands not listed in BHE 2005 were identified during a site visit conducted by CH2M HILL on July 27, 2007. Two of the potential wetlands were identified in the proposed project area, and one potential wetland was identified adjacent to the project area for the relocated gate (Figure 10). An official delineation was not conducted; however, the wetlands were estimated to be 0.01 acre, 0.05 acre, and 0.11 acre. All of these wetlands meet the criteria for Category 2 wetlands according to the Ohio EPA Ohio Rapid Assessment Method (ORAM).

3.3 Water Resources

3.3.1 Groundwater

Groundwater within WPAFB occurs under both water table conditions within the Mad River buried valley aquifer and under confined to semiconfined conditions within low permeable deposits, primarily within Area B. The underlying bedrock is primarily low permeable shale and does not constitute an aquifer (Dumouchelle et al., 1993).

Groundwater at the proposed site in Area B occurs under two circumstances: water table conditions and in bedrock, at depths ranging from just below the surface to 35 feet bgs (IT Corporation, 1997a). The water-bearing zone in this region of Area B is part of the "Hill" aquifer as defined in the *Groundwater Flow Modeling Technical Memorandum* (IT Corporation, 1997b) and is of low hydraulic conductivity. The groundwater flow pattern through this region is created by a bedrock ridge that trends northwest from the southeast corner of Area B to Huffman Dam (Dumouchelle et al., 1993).

The Hill aquifer in Area B is not directly used as a drinking water supply and is not a major source of recharge to the Mad River buried valley aquifer system, which is designated as a sole source aquifer. Area B is supplied water from four WPAFB-owned and operated wells located near Springfield Street; these wells obtain water from the Mad River buried valley aquifer. The City of Dayton's Mad River well field, located along the Mad River northwest of Area B, is one of several other well fields that withdraw drinking water from the aquifer.

3.3.2 Surface Water

The surface water features at the proposed locations for infrastructure upgrades and the HPW complex are open drainages, man-made ditches, and concrete-lined channels.

In the central portion of the Hilltop District project area, surface water features are limited to shallow, unlined drainage ditches along the roadways. North of 5th Street between Q Street and Hobson Way, there are two defined open drainages. These drainages are shown on Figure 11 to begin where they exhibit groundwater discharge or steady flow. These drainages flow north to meet just north of 1st Street, then beneath Kauffman Avenue, and then turn east to eventually flow to Hebble Creek and the Mad River. The drainages appear to meet the definition of "relatively permanent waters" according to USACE's Jurisdictional Determination Form Instructional Guidebook (2007), and the USEPA and USACE memorandum, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States & Carabell v. United States* (2007). All appear to have at least seasonal continuous flow and a significant nexus to traditional navigable waters, namely the Mad River. Roadside drainages, storm drains, and gullies that discharge into these drainages above the steady-flow points do not appear to be regulated waters.

In the area of the relocated gate, there are three small streams, all of which originate at the outfalls of storm drains. The main stream (Stream 1 on Figure 10) receives drainage from a large culvert from the south. A small intermittent tributary enters Stream 1 from the west. A third stream (Stream 2 on Figure 10) flows east to a roadside drainage along National Road, and eventually joins Stream 1 at a large culvert beneath National Road. The streams flow east to a perennial stream east of National Road, and eventually north to Hebble Creek and the Mad River. All of these streams appear to meet the definition of "relatively permanent waters."

Storm water from most developed areas in Area B is captured by shallow drainages and catch basins, and then routed through underground storm sewer lines or open drainages to one of five outfalls: Outfalls 001, 002, 003, 004 (Mad River), and 005 at Hebble Creek (Figure 11). In addition, two site-specific discharge points, Outfalls 22 and 23, occur within Area B. Outfall 22 collects final effluent

from the coal pile runoff treatment facility (near Facility20770) and discharges to unnamed tributaries of Hebble Creek. Outfall 23 collects storm water from the aircraft survivability test area after flowing through an oil/water separator, and discharges to an unnamed tributary of the Mad River (Shaw Environmental, Inc., 2006). Storm drainage exits Area B by several paths through a combination of surface drainage and storm drains.

Potential impacts to water quality from storm water discharge are regulated under Section 402 of the CWA, also known as the National Pollutant Discharge Elimination System (NPDES). Ohio EPA administers this section in Ohio.

Permits are required for discharges of storm water from construction sites. Storm water runoff from construction activities has the potential to impact water quality by contributing sediment and other pollutants exposed at construction sites. The NPDES Storm Water Program requires operators of both large and small construction sites to obtain authorization to discharge construction storm water under a general permit. Under the Phase II rule, a permit would be required for a construction site involving greater than 1 acre of land. A notice of intent (NOI) serves as the application of the general permit. As part of the NOI application, a storm water pollution prevention plan must be submitted that specifies the erosion control measures to be taken. Regular monitoring would be required to ensure that these measures are implemented and effective in erosion control.

3.3.3 Floodplains

WPAFB is located within the Mad River Valley of the Great Miami River Basin. A 1994 study by USACE calculated the 100-year floodplain elevation to be 814.3 feet above mean sea level (msl) for the Mad River Basin that extends from Springfield, Ohio, to the Huffman Dam. The proposed locations of the infrastructure upgrades and HPW complex are at an elevation ranging between 800 and 970 feet msl; however, Flood Insurance Rate Map Panels 390193 0025C and 390193 0005 B for Greene County, Ohio, show that all of the Area B proposed infrastructure upgrade and HPW complex areas are located outside of the Mad River 100-year floodplain.

3.4 Hazardous Materials/Waste, Stored Fuels, and Installation Restoration Program

3.4.1 Hazardous Materials/Waste

Hazardous substance management at WPAFB is governed by WPAFB Operating Instruction 32-7002, *Hazardous Materials,* and WPAFB Operating Instruction 32-7001, *Hazardous Wastes*. As used in this section, HAZMAT is used to cover hazardous materials and HW is used to cover hazardous waste. HAZMAT most commonly used at USAF bases include aviation and motor fuels; numerous types of petroleum products such as motor oils, lubricants, and hydraulic fluids; cleaning solvents and agents; pesticides and herbicides; paints and paint thinners; acids; corrosives; caustics; compressed gases; aerosols; fire retardants; and munitions.

HW commonly generated at the base includes flammable solvents, contaminated fuels and lubricants, paint/coating, stripping chemicals, waste paint-related materials, and waste oil. Each waste-generating organization and the Environmental Management Division (88 ABW/CEV) is responsible for managing HW. There are two 90-day storage areas located at WPAFB: Building 247 in Area C and Building 479 in Area B. Building 479, located southwest of the project area, is licensed as a 1-year treatment, storage, and disposal facility under the WPAFB Resource Conservation and Recovery Act (RCRA) Part B permit; however, it is currently and historically operated as a 90-day storage area.

The HPW complex will consist of research laboratories which will use several of the HAZMAT mentioned above. The exact quantities of HAZMAT to be used and stored in the HPW complex is not known at this time; however, based on historical waste generation activities of the incoming organizations, it is estimated that Area B HAZMAT usage and storage will increase by at least 40 percent. Likewise, it has been calculated based on historical waste generation activities of the incoming organizations that the generation of hazardous, non-hazardous, and universal wastes will increase approximately 40,000 pounds per year. This is a 40 percent increase to the total wastes currently generated at WPAFB.

To facilitate the construction of the new entrance road/gate into the base, Facility 20682 needs to be demolished. This facility is used by the NLC for movie film maintenance and processing activities. The NLC is moving out of the facility in the first quarter of FY 2008, and the facility is scheduled to be demolished shortly thereafter. The activities conducted at the facility involve a number of hazardous chemicals and materials. These chemicals and the majority of the machines containing hazardous chemicals will be removed prior to demolition. On June 4, 2007, Environmental Quality Management Inc. (EQM) conducted a site inspection for Facility 20682 to document potential concerns associated with demolition of the facility. Results of the inspection are documented in the report *Building 20682, Wright Patterson Air Force Base, Pre-Demolition Environmental Site Inspection for Asbestos and Hazardous Chemicals* (EQM, 2007).

Current and past use of chemicals includes sulfuric acid, acetone, acetic acid, film cement (1,4-dioxin, acetone, and dichloromethanol), isopropyl alcohol, stabilizer additive (1,2-tridecylalcohol and polyoxyethynol), perchlorethylene, and various household and maintenance shop chemicals. These chemicals are stored in volumes of 30 gallons or less. Storage cabinets will be decontaminated or removed prior to the facility demolition. Sodium hydroxide, boric acid, bisulfate, sodium bromide, and ethylene glycol are stored in bulk quantities of 10 to 80 gallons. Perchloroethylene raw materials are stored in 55-gallon drums in a HW storage room. Ethylene glycol is present in a 55-gallon drum and two 80-gallon holding tanks in the mechanical room. Generally, HW generated from facility operations included solvents and nitrocellulose film, which was stored in a cold room in water prior to disposal (EQM, 2007).

Process equipment that used HAZMAT or generated HW that will be removed by the NLC as it vacates the building include two solvent cleaning machines, two film processing units, and four optical printers that contained perchlorethylene. Equipment that will be left in the building that would be a concern during possible demolition activities include a 500-gallon unregulated, underground process neutralization tank (the tank will be cleaned prior to the facility demolition); a carbon drum treatment system used to capture and treat various air emissions associated with various machines and hoods used in the building; mechanical equipment, a compressor; 20 thermostats

observed in the building that may contain mercury; over 50 light fixtures with potential polychlorinated biphenyl (PCB)-containing ballasts; and approximately 200 fluorescent fixtures.

The underground process neutralization storage tank is a 20-plus-inch diameter plastic barrel that is approximately 4 feet deep in the ground; the top of the barrel is flush with the floor surface. It drains by gravity and is fed by the other drains in the room. The outlet pipe is higher than the two inlet pipes; therefore, water will stand in the pit. During the days of film processing, process chemicals that went to the overflow of the processing machines were diluted when they left the equipment. They were further diluted with 20 to 30 gallons per minute (gpm) of water prior to reaching the pit. WPAFB has sampled the pit several times, and no metals have been detected. As long as the dilution process has been in place, base personnel are not aware of any documented event of exceeding metals and/or photo chemical levels to the sanitary sewer.

3.4.2 Stored Fuels

WPAFB contains both aboveground storage tanks (ASTs) and underground storage tanks (USTs), which are used to store fuels and petroleum, oils, and lubricants (POLs). USTs are subjected to federal regulations implementing RCRA, contained in 40 CFR Part 280. The State of Ohio regulates USTs under Ohio Administrative Code (OAC) 1301:7-9. ASTs are regulated under the federal Oil Pollution Prevention and Response Regulation and the WPAFB Spill Prevention Control and Countermeasure (SPCC) Plan.

Based on a review of the base UST and AST location maps, there are no USTs located in the Downtown District; two ASTs (159 and 228) are located in the Downtown District at the northwest corner of Monohan Way and F streets. Four USTs are located within the Hilltop District project area—three USTs (249, 250, and 251) are located at the southeast corner of Monohan Way and Skyline Drive adjacent to Facility 20464; one UST (310) is located at Facility 20451. The USTs at Facilities 20464 and 20451 are out of service and will be removed in FY 2008 (WPAFB, 2007c). Twenty-one ASTs are located within the Hilltop District project area—three ASTs (571, 597, and 598) are located at Facility 20304 on Monohan Way; one AST (638) is located at Facility 20464; two ASTs (227 and 268) are located at Facility 20450 near the corner of Q and 5th streets; three

ASTs (177, 178, and 321) are located at Facility 20837 along Q Street; two ASTs (174 and 564) are located at Facility 20838 along Q Street; three ASTs (288, 298, and 299) are located at Facility 20824 along Q Street; five ASTs (244, 245, 246, 247, and 248) are located at Facility 20682; one AST (318) is located at Facility 20645; and one AST (173) is located at Facility 20642.

The design proposal for the HPW complex states that two 750-kilowatt (kW) generators would be installed for the south facility and one for the north. The associated generator fuel tanks would hold enough fuel for 24 hours of full operation.

3.4.3 IRP Sites

The DoD developed the IRP to identify, assess, and control potential environmental contamination that may have resulted from past operations and waste disposal practices. The IRP, an element of the Defense Environmental Restoration Program, is a part of the environmental program at each DoD installation. WPAFB has identified 68 IRP sites per the Air Force Restoration Information Management System (AFRIMS). WPAFB has grouped all confirmed or suspected sites requiring investigation and characterization in 11 geographically based operable units (OUs), designated OUs 1 through 11 (IT Corporation, 1999). In addition to the 11 OUs, WPAFB addressed basewide issues of groundwater and surface water contamination under the Basewide Monitoring Program (BMP) (IT Corporation, 1995).

A large portion of the project area lies within the boundary of OU9 (Figure 12). OU9 is a collection of 11 discrete IRP sites, nine of which have been used for the disposal of earthfill materials (earthfill disposal zones [EFDZs] 2, 3, 4, 5, 6, 7, 8, 9, and 10), one burial site (BS3), and one heating plant (HP5). An environmental investigation of OU9 was completed in 1997, the results of which are documented in the *Final Remedial Investigation Report, Operable Unit 9* (IT Corporation, 1997a) and the *Record of Decision for 41 No Action Sites* (WPAFB, 1998). Several of the OU9 IRP sites (EFDZs 2, 3, 4, 6, 7, and 8) are located adjacent to or within proposed upgrades (such as roadway improvements). EFDZs 2 and 3 are grassy areas located adjacent to and west of Skyline Drive. EFDZ 4, located south of EFDZs 2 and 3, consists of paved streets and grassy open areas. EFDZ 6, located east of Q Street behind Facilities 20837 and 20838, consists of a grassy open area and

parking lot. EFDZs 7 and 8, located east of EFDZs 2 and 3, consist of grassy open areas and paved streets.

A portion of the project area (that is, Downtown District) also lies within the boundary of OU8. OU8 consists of Spill Site 5, UST 71A, Spill Site 7, Spill Site 9, and Spill Site 11. An environmental investigation of OU8 was completed in 1997, the results of which are documented in the *Final Remedial Investigation Report, Operable Unit 8* (CH2M HILL, 1997) and the *Record of Decision for 41 No Action Sites* (WPAFB, 1998). None of the OU8 IRP sites are located within or adjacent to the proposed infrastructure upgrade locations.

Two other IRP sites are located near the project area, but are not associated with an OU. The radioactive waste burial site (RWBS), located east of EFDZs 7 and 8 and west of Hobson Way, was a 7–foot-by-7-foot concrete slab used as a staging area for drums of radioactive waste prior to shipment and disposal offsite. The slab and underlying soil was removed in 1990. Heating Plant 1 (HP1) is located at the northwester corner of the Downtown District project area. While the plant was in operation, a coal pile was stored within an adjacent concrete structure. The former coal storage area was paved after the heating plant consolidation, and currently is used as a parking lot. Documentation regarding the RWBS and HP1 can be found in the *Record of Decision for 41 No Action Sites* (WPAFB, 1998).

3.5 Land Use

WPAFB is divided into three areas: A, B, and C. Areas A and C are located within the boundaries of Patterson Field. The land use in Area A is mixed between administrative offices, housing, industrial, medical services, and outdoor recreation. Land use in Area C includes activities associated with airfield operations and maintenance, as well as industrial, community commercial, community service, administration, outdoor recreation, and open space. Land use in Area B, or Wright Field, primarily consists of research and development. The base encompasses 8,145 acres and is classified as non-industrial with mixed development (Woolpert, 2001).

As discussed previously, the project area is located in a part of Area B referred to as the Hilltop District (the property primarily occupies the hilltop portion of Area B), with a small portion of the project area located in the Downtown District. Much of this land was acquired during World War II for wartime space requirements. The proposed infrastructure upgrades and HPW complex in the Hilltop District are located on lands currently designated as follows:

- Research and Development—the project area east of Q Street in the proposed area of the Vivarium addition and the Downtown District project area. Area B primarily consists of research and development activities. The central portion of Area B has many "industrial style" research and development facilities primarily used for propulsion and air vehicles research. The eastern half of Area B includes more research and development facilities including materials and manufacturing, a portion of HE, and the Sensors Directorate laboratory.
- Community Service—the project area west of Hobson Way and south of 5th Street.
- Administrative—the project areas west of Hobson Way and north of 10th Street; west of Hobson Way and north of 5th Street; and the area east of Q Street where Facility 20682 is located.
- Community Commercial—the project areas north of Facility 20682 and west of Hobson Way north of 8th Street.
- Open Space—the open lawn areas between Q Street and Hobson Way from 10th Street to Kauffman Avenue. Open space is the one of the dominant land uses in the Area B Hilltop District. Areas of open space on the east end of Area B are scattered between research facilities along P Street, Q Street, and Skyline Drive. Much of the open space is intended to be redeveloped. Some areas are undeveloped for several reasons, including cultural resource constraints (Woolpert, 2001).
- Outdoor Recreation—the open lawn and forested area between Q Street and National Road where a parcourse fitness trail is located in the area of the proposed new entrance road into the base.

As stated in Section 3.10, the project area is outside all the Accident Potential Zones (APZs).

3.6 Soil

According to the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) soil survey of Greene County, Ohio (USDA SCS, 1978), the study area soil (0 to 5 feet bgs) is primarily composed of silt to clay loam belonging to the Miamian Series, but also includes smaller portions of the Raub Series and Ritchey Series.

Miamian Series soil consists of nearly level to steeply sloped soil that formed in glacial till. The surface soil consists of brown silty clay loam from 0 to 7 inches deep, yellowish brown clay and clay loam from 7 to 24 inches deep, and brown loam from 24 to 32 inches deep. The substratum is yellowish brown loam and is encountered at depths of 32 to 60 inches. These soils exhibit moderately low permeability and are well-drained.

Raub Series soil consists of nearly level to gently sloping soil that formed as loess on top of glacial till. The upper 8 inches of the surface soil consist of very dark gray silt loam. The subsurface soil consists of very dark grayish brown silty clay loam from 8 to 14 inches deep, mottled yellowish brown silty clay loam from 14 to 27 feet deep, and mottled yellowish brown clay loam from 27 to 60 feet deep. These soils are poorly drained with moderate permeability in the loess and low permeability in the lower glacial till.

Ritchey Series soil consists of gently sloping to steeply sloping soil formed in glacial till. The surface soil is very dark grayish brown silt loam from 0 to 4 feet deep. The subsurface soil is yellowish brown silt loam from 4 to 7 feet deep, yellowish brown clay loam from 7 to 11 feet deep, and dark yellowish brown clay from 11 to 18 feet deep. Limestone bedrock is encountered at a depth of 18 feet or less. These soils are well drained with moderate permeability.

The dominant soil types surrounding the proposed sites in Area B are Miamian-Urban land complex, rolling (MrC) and undulating (MrB). Soil types MrC and MrB have from 40 to 80 percent of the land surface covered with pavement and earthfill, and the remaining areas are undisturbed Miamian soils. The depth to bedrock is expected to be approximately 5 feet or less and would be verified during the exploratory borings prior to construction.

The dominant soil type in the area near 1st Street and Kauffman Avenue and at the substation upgrade location is Raub silt loam (RdB), which has 80- to 150-foot-long convex slopes—bedrock is expected to be encountered at approximately 8 to 10 feet or less and would be verified during the exploratory borings prior to construction.

The dominant soil type between Q Street and National Road in the area of the proposed relocated gate is Miamian silt loam (MhC2). These are sloping soils on moraines and on side slopes adjacent to drainage ways. The depth to bedrock is expected to be approximately 5 feet or less and would be verified during the exploratory borings prior to construction.

Less dominant soils also located near the proposed sites are two types of Ritchey silt loams (RhD and RhE2). These are moderately steep soils located on bedrock-controlled uplands overlooking river channels—the depth to bedrock is expected to be less than 10 inches and would be verified during the exploratory borings prior to construction.

3.7 Cultural Resources

Cultural resources consist of archaeological sites, buildings, structures, districts, properties of traditional and cultural importance, and cultural landscapes that are significant to American history, architecture, archaeology, engineering, and culture. According to the criteria in the National Historic Preservation Act, significant sites or properties are those that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and are shown to be significant for one or more of the following four criteria for evaluation:

- **Criterion A—Events:** Properties associated with events that have made a significant contribution to the broad patterns of our history
- **Criterion B—Persons:** Properties associated with the lives of persons significant in our past
- **Criterion C—Design:** Properties that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction
- **Criterion D—Information:** Properties that have yielded or may be likely to yield information important in prehistory or history

Properties considered significant according to these criteria are eligible for listing on the National Register of Historic Places (NRHP). Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effect of any undertaking on these cultural resources. WPAFB has completed an extensive inventory of historic and prehistoric resources. The studies to date and the resources identified are described in the Integrated Cultural Resources Management Plan (ICRMP) (WPAFB, 2006a).

3.7.1 Historic Buildings and the Wright Field Historic District

Inventories of buildings that were constructed throughout the base through 1956 (at or approaching 50 years old or older) have identified the facilities that are potentially eligible for listing on the NRHP. Continuing surveys are being programmed to evaluate other facilities as they approach 50 years of age. The State Historic Preservation Office (SHPO) has reviewed all of the facility survey

information WPAFB has collected and has reached a consensus determination of eligibility for listing on the NRHP for facilities at WPAFB.

Picnic shelter (Facility 20210) in the Officers' Recreation Area

The Hilltop District, east of Skyline Drive, contains few historic buildings (Figure 13). None of these buildings occur within the project area.

Spring house (Facility 20211) in the Officers' Recreation Area

The majority of Area B west of Skyline Drive has been designated as the Wright Field Historic District, because of the density of historic buildings that are individually eligible for listing on the NRHP and overall historic integrity of this area. The larger Hilltop District project area borders the Historic District to the east, while the smaller Downtown District project area, where two wastewater line upgrades are proposed, is located within the Historic District. Many historic buildings and other features in this district date to the original Wright Field era (1925–1939) and the Army Air Corps era (1940–1945). The Wright Field Historic District is eligible for listing on the NRHP; therefore, all "contributing features" in the Historic District are provided protection under Section 106 of the National Historic Preservation Act. Several protected buildings are located in and adjacent to the Downtown District project area (Figure 13).

Wright Field also has been designated a cultural landscape (see National Park Service Preservation Brief 36). Cultural landscapes are areas where the view of the historic landscape has been preserved

and incorporates important historic features. Features considered in the designation of this area as a historic landscape are overall site organization according to Quartermaster Corps principles, response to natural features (such as topography, weather patterns, and water features), circulation system (roadways, railways, parking lots, etc.), land use areas, building cluster arrangements, and vegetation.

An important element of the Historic District and the historic landscape is the Officers' Recreation Center, in the partially wooded terrace between L Street and Skyline Drive. This area borders the western edge of the Hilltop District project area. This park-like recreation area dates to 1937–1940 and contains large trees and several original facilities such as stone fireplaces, rock retaining walls, rock-lined drainage swales, a spring house along L Street (Facility 20211), and a picnic shelter (Facility 20210).

3.7.2 Archaeological Resources

In 1990, the U.S. Army Construction Engineering Research Laboratory (USACERL) conducted a prehistoric survey covering 400 acres located in the Hilltop District area (Figure 13). The following three prehistoric archaeological sites were discovered: 33 GR 796, 33 GR 797, and 33 GR 798. In August 2002, Hardlines Design Company conducted Phase II testing of these three sites, and WPAFB concluded, with SHPO concurrence, that the three sites were not eligible for the NRHP. In October through December 2001, Gray & Pape, Inc. conducted Phase I investigations at WPAFB as a part of the base's ongoing Section 110 responsibilities for identifying and protecting historic properties on its land. The project was focused on identifying potential prehistoric resources located in areas previously identified as having a low to moderate probability for containing prehistoric sites. An area between National Road and Q Street was surveyed, and Site 33 GR 1171 was discovered, but it lacked research potential because of its light density of cultural remains. WPAFB determined the site to be ineligible for the NRHP, and SHPO concurred in a letter dated April 5, 2002.

Thus, the only known NRHP-listed archaeological resource located within the project area is the Adena mound, Site 33 GR 31, which is located at the corner of Hobson Way and 7th Street (Figure

13). An archaeological survey was conducted in the vicinity of the Adena mound in 1991 as part of the WPAFB Historic Resources Management Plan (USACERL, 1993). No artifacts were found in the area surrounding the mound. The management plan for the site is to preserve it in place.

3.8 Air Quality

According to the Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS) are to be set by USEPA. The NAAQS are designed to limit pollution in the air anywhere in the United States in order to protect human health and public welfare. The NAAQS have been established for six criteria pollutants, which include sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO), ozone, and lead. Sections 107 and 110 of the CAA give the responsibility to each state for developing a set of regulations that implement the NAAQS, called state implementation plans (SIPs).

The Ohio EPA is responsible for developing the SIP and implementing and enforcing the environmental regulatory requirements outlined by USEPA, including monitoring for criteria pollutants to determine whether the levels meet the criteria pollutant attainment standards. WPAFB is located in the Dayton/Springfield area for ozone NAAQS, which covers Clark, Greene, Miami, and Montgomery counties. On April 14, 2004, USEPA designated the Dayton/Springfield area as "basic nonattainment" for the 8-hour ozone NAAQS. This designation was published in the April 30, 2004, *Federal Register* notice (69 FR 23858). USEPA also published the *Final Rule to Implement the 8-hour Ozone National Ambient Air Quality Standard—Phase 1* on April 30, 2004 (69 FR 23951). On April 5, 2005, USEPA designated the Dayton/Springfield area (Clark, Montgomery, and Greene counties) as nonattainment for particulate matter less than 2.5 microns in size ($PM_{2.5}$). The publication of the attainment and nonattainment area designations triggered a need for Ohio EPA to develop a revision to its SIP. In November 2006, Ohio EPA sent a letter to USEPA requesting to have the ozone nonattainment title changed to attainment for the four counties. On August 13, 2007, the Dayton/Springfield Air District was changed from 8-hour ozone nonattainment to attainment.

Section 176(c) of the CAA requires that before a federal entity takes an action, it must make a determination that the proposed action will not interfere with the SIP or the state's ability to attain and maintain the NAAQS. In 1995, Congress limited the application of Section 176(c) to nonattainment and maintenance areas only.

USEPA established de minimis emissions levels and exempted certain actions. USEPA also allowed federal entities to develop their own list of actions, which are presumed to conform. For nonexempt actions that increase emissions above the de minimis levels, the federal agency must demonstrate that the action will conform with the SIP or will not cause or contribute to any new violation of any standard in any area; interfere with provisions in the applicable SIP for maintenance of any standard; increase the frequency or severity of any existing violation of any standard; or delay timely attainment of any standard or any required interim emissions reductions or other milestone.

USEPA is reviewing the general conformity program and may revise the regulations, as appropriate with respect to the 8-hour standard. USEPA is proposing to retain the existing de minimis emission levels for volatile organic compounds (VOCs) and NO_x (both ozone precursors). The existing de minimis emission levels do not include the "basic" nonattainment category. The de minimis emission levels for a "moderate" nonattainment area are 50 tons per year (tpy) for VOCs and 100 tpy for NO_x. The de minimis emission levels for an "other" nonattainment area are 100 tpy for VOCs and 100 tpy for NO_x. It has been assumed that the "basic" category thresholds will be no more restrictive than the "moderate" category threshold, and thus, the "moderate" category threshold has been used in this assessment.

WPAFB, which is considered a major source of air pollutants, submitted an application for a CAA Title V air quality operating permit in February 1996. Ohio EPA issued a final permit on January 27, 2004, with an effective date of February 17, 2004, identifying all sources of air pollution, applicable regulatory requirements, and emission limits. Planned construction activities (infrastructure upgrades and HPW complex) have the potential to exceed existing limits in the Title V permit. See Section 4.8 for more information.

3.9 Noise

Noise can be defined as sound that is undesirable because it disrupts speech communication and hearing, is intense enough to damage hearing, or is otherwise irritating. When measuring sound to determine its effect on human population, A-weighted sound levels in decibels (dB) are typically used to account for the response of the human ear. A-weighted sound levels represent adjusted sound levels according to a prescribed frequency response established by the American National Standards Institute (ANSI, 1983).

To address both noise and safety, the DoD required military departments to establish an Air Installation Compatible Use Zone (AICUZ) program. The goal of AICUZ is to promote compatible land use on and off base to minimize noise complaints and safety hazards. Noise generated by aircraft approaching and leaving the main runway at Patterson Field (Area C) has been modeled based on the type and number of aircraft, and is expressed as the average day-night noise level in dB. The day-night noise level is mapped as contours in increments of 5 dB, radiating from the main airfield. The airfield near the museum in Area B is so infrequently used that it is not included in the model. According to the AICUZ study, the Hilltop District project area is located in the current operations noise contours of less than 65 dB and 65 to 70 dB (WPAFB, 1995). The Downtown District portion of the project area is located in the current operations noise contours of 70 to 75 dB (WPAFB, 1995). Under a maximum mission noise scenario, the project area is located in the 65 to 70 dB, 70 to 75 dB, and 75 to 80 dB contours. Typical noise sources in and around the area include human activities and aircraft.

The Occupational Safety and Health Administration (OSHA) has established noise exposure standards in order to protect the hearing of employees. One such standard is designed to protect general industry employees, such as those working in the manufacturing, utilities, and service sectors (1910.95, Occupational Noise Exposure). OSHA standards for noise in the construction industry include 1926.52, *Occupational Noise Exposure*, and 1926.101, *Hearing Protection*. Other federal agencies and organizations have established similar criteria. The American Conference of Governmental Industrial Hygienists (ACGIH) has established exposure guidelines for occupational exposure to noise in its threshold limit values, and the National Institute for Occupational Safety and

Health (NIOSH) recommends following noise exposure criteria established in the Criteria for a Recommended Standard: Occupational Noise Exposure—Revised Criteria, Publication No. 98-126 (NIOSH, 1998).

3.10 Health and Safety

The major categories of health and safety issues associated with the infrastructure upgrades include worker safety and public safety during construction activities and plane flight paths within the base. Worker safety concerns during construction activities would primarily include hazards associated with physical hazards (for example, heavy equipment and vehicles, and power tools), underground utilities, and potential HAZMAT (for example, fuels).

The USAF AICUZ program is intended to reduce the potential for aircraft mishaps in populated areas. As a result of this program, WPAFB has altered basic flight patterns to avoid heavily populated areas. In addition, airfield safety zones were established under AICUZ to minimize the number of people who would be injured or killed if an aircraft crashed. Three safety zones are designated at the end of all active runways: Clear Zone, APZ I, and APZ II. The Clear Zone represents the most hazardous area. Although administrative uses (industrial, business services, manufacturing) are permitted in the APZs, "people-intensive" uses (for example, auditoriums, classrooms) are discouraged in these areas. According to AFI 32-7063, all new construction is required to comply with the AICUZ. The proposed site of the infrastructure upgrades and HPW complex (that is, the Area B Hilltop District) is located outside all APZs at WPAFB.

3.11 Socioeconomics

WPAFB is the largest employer in the region. WPAFB has a work force numbering approximately 20,500 people, and employs nearly 1 in 12 people in the greater Dayton area. Approximately 92 percent of WPAFB's military and civilian employees live in the Dayton-Springfield Ohio Metropolitan Statistical Area (MSA) that includes Greene, Montgomery, Clark, and Miami counties. It is the fifth largest employer in the state of Ohio and the largest employer at a single location. The base has an annual payroll of approximately $1.25 billion. Annual expenditures by WPAFB, including services, equipment, materials, and supplies, total about $1.55 billion. The value of

secondary jobs created is estimated to be $800 million, for a total economic impact of the base in the regional economy of $3.6 billion. In 2005, approximately $2.2 million of educational impact aid funds were distributed to five local school districts that serve children of active military and civilian employees (WPAFB, 2005).

Statistics provided by the Ohio Department of Development and Federal Census Bureau indicate that the percent of the population below poverty level in 2000 in Ohio and the three-county area was lower than the national average. On the other hand, in 2004, per capita income in Ohio and in the three-county area was below the national average. Since 2002, Ohio's unemployment rate also has been consistently higher than the national rate. There is speculation that this drop is largely a result of the loss of manufacturing jobs throughout the state over the last few years (Policy Matters Ohio, 2007). In general, Montgomery and Clark counties' poverty and unemployment rates are higher than the state average, while Greene County is lower than the state average (Table 4).

TABLE 4
Regional Economic Profile

	Average per Capita Income (2004)	Percent below Poverty Level (2000)	Percent Unemployment				
			2002	2003	2004	2005	2006
Greene	$32,497	8.5	5.0	5.4	5.5	5.5	5.0
Montgomery	$31,773	11.3	6.0	6.5	6.6	6.4	5.9
Clark	$28,094	10.6	7.0	7.3	6.7	6.4	5.7
Miami	$30,411	6.7	5.6	5.9	5.7	5.6	5.7
Ohio	$31,161	10.6	5.7	6.2	6.2	5.9	5.4
United States	$33,050	12.4	5.8	6.0	5.5	5.1	4.3

Population growth statistics for the four-county area are provided in Table 5. Greene and Miami counties show a slight increase in population, while Montgomery and Clark counties show a slight decrease in population. The estimated percent of vacant housing in 2004 for Greene, Montgomery, Clark, and Miami counties was 5.0 percent, 7.7 percent, 7.2 percent, and 5.2 percent, respectively (ODOD, 2006).

TABLE 5
Area Population Growth Statistics

County	Total Population for 2000[a]	Estimated Population for 2004[b]	Percent Change in Population
Greene	147,886	152,233	2.9% increase
Montgomery	559,062	550,063	1.6% decrease
Clark	144,742	142,613	1.5% decrease
Miami	98,868	100,797	1.9% increase

[a] U.S. Census Bureau (2000)
[b] Ohio Department of Development (2006)

3.12 Transportation/Traffic

A substantial volume of commuter traffic accesses Area B daily. According to recent traffic counts and analysis in and around Area B, the average daily traffic into and out of Area B is roughly 16,500 vehicles (Table 6) (KZF/BWSC, 2007b). The morning peak hour traffic is the greatest, with 3,666 vehicles entering Area B.

Traffic enters and exits Area B by way of three gates: Gate 22B, which links directly to Interstate 675 (I-675); Gate 1B to Springfield Street; and Gate 19B to National Road (Figure 3). Gate 1B and 22B are open continuously, while Gate 19B is only open during the morning and evening peak traffic hours. Generally, drivers enter at the gate nearest their destination. Approximately 42 percent of the morning peak hour traffic enters through Gate 22B, 24 percent through Gate 1B, and 34 percent through Gate 19B.

TABLE 6
Traffic Levels at Area B Gates

Gate	Average Daily Traffic			Morning Peak Hour			Evening Peak Hour		
	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total
1B	4,978	3,486	8,464	892	491	1,383	637	612	1,249
19B (open peak hours only)	2,914	2,280	5,194	1,252	123	1,375	101	953	1,054
22B[a]	8,601	n/c	---	1,522	n/c	---	1,188	n/c	---
TOTAL	16,493			3,666			1,926		

Source: KZF/BWSC, 2007b
[a] This gate is open only for inbound traffic during the morning peak hour.
n/c = not counted

Gates 1B and 22B are updated designs with sufficient capacity to accommodate the queuing of inbound vehicles caused by security checks. Gate 19B has a smaller capacity for vehicles queuing at the security checkpoint because the checkpoint is located only a short distance from National Road, and because it can accommodate only two inbound checkpoint lanes. Consequently, backups of traffic occur on National Road in both the north and southbound directions during the morning peak hour.

Within Area B, most roadways are two lanes. The primary arterials (main thoroughfares) are Loop Road, a three- to-four-lane road that runs along the west side of Area B from 13th Street (northeast of Gate 22B) to Gate 1B; and Hobson Way, which runs south from 5th Street near Gate 19B to connect to Loop Road at 13th Street. Together, these roads make a continuous southern loop between Gates 19B and 1B.

Although it is discontinuous between K Street and Skyline Drive, 5th Street, which runs east and west between Gate 1B and Gate 19B, also is considered a primary arterial. The west leg of 5th Street is three lanes (center turn lane) between B Street and K Street. The east leg of 5th Street through the Hilltop District is four lanes. Because 5th Street is discontinuous, east to west bound traffic on the

north side of Area B must travel secondary arterials and collector streets (3rd Street/Monahan Way, 8th Street, or 10th Street) to complete the east-west connection.

Level of service (LOS) is a composite measure of the operational efficiency of a roadway, based on the amount of delay relative to travel at the design speed (seconds per vehicle) and the density of vehicles (cars per mile per lane). There are six LOS levels, from A, which is optimal, to F, which represents severely congested (often stop and go) traffic. Typically, the goal is to provide a LOS of C or better during the peak hours, although in the case of urban areas, LOS D is acceptable.

Acceptable LOSs are found along each of the internal roadways and at most major intersections during the peak hours (Appendix G). Minor delays occur at intersections near the gates. The most significant delays are found at the gates during the morning peak hours. In the project area, morning peak hour delays occur at Gate 19B for inbound traffic. Also, the intersection of 13th Street and Hobson Way experiences somewhat degraded traffic operations during the peak hours. This intersection currently is controlled with a stop sign along Hobson Way.

3.12.1 Roadway Condition

The roadway surfaces in the project area are in variable condition. Some of the pavement is sufficiently maintained, some of it is in poor condition. In the Hilltop District, Q Street, Monahan Way, 1st Street, and Hobson Way north of 5th Street are particularly in need of some repair.

3.12.2 Parking

Parking is adequate in the project area for the existing uses. Parking is provided in a number of surface lots generally close to the buildings they serve. On-street parking is provided along main roadways in the Hilltop District including Q Street, 5th Street, and Hobson Way. In the western, Downtown District of Area B, overall parking capacity is adequate, although the preferred parking is in lots adjacent to many facilities. There are a number of small parking lots with individual entrances and exits along 5th Street; the density of these lot entrances and exits is a hindrance to the full function of this roadway as a primary arterial.

3.13 Utilities

3.13.1 Steam Heating

Three coal-fired boilers at Building 770 provide the majority of the heat for Area B facilities. The heat is supplied as steam distributed through a network of aboveground and belowground pipelines (Figure 9). Each coal-fired boiler can generate 120,000 pounds per hour (lb/hr) of steam. Currently, loads typically peak near 220,000 lb/hr on cold days, meaning that continuous firing of two boilers is adequate to handle the load, and the third boiler is kept in reserve. The plant also contains two natural gas-fired backup boilers that can each produce 80,000 lb/hr. There are a few gas-fired satellite heating plants at WPAFB, although none serve the project area.

Aerial steam line "A" across the proposed HPW complex site.

From Building 770, the steam pipeline passes south through a tunnel beneath Kauffman Avenue and emerges above ground south of 1st Street. Here, the steam is distributed by an "A" line and a "B" line. The "A" line proceeds south as an aerial line approximately 150 to 200 feet west of Q Street. The "A" line proceeds above ground to just north of 5th Street, where it turns due east and goes underground across Q Street. This line then runs underground to the south along Q Street.

The "B" line proceeds southwest as an aerial line to 3rd Street. At that point, the line runs underground along 3rd Street, and then turns south. It continues south underground, about 270 feet east of Skyline Drive, through the proposed ITC campus and to facilities south of ITC. Combined, the "A" and "B" lines have the capacity to carry all of the steam generated by the coal-fired boilers. The "J" cross-tie line connects the "B" line to the "A" line north of 10th Street to create a loop and balance the pressure in the system.

3.13.2 Water

All of Area B is supplied water from four WPAFB-owned and operated wells. These wells are located near Springfield Street and obtain water from the Mad River buried valley aquifer. The City of Dayton's Mad River well field, located along the Mad River northwest of Area B, is one of several other well fields that withdraw drinking water from the aquifer.

The Mad River buried valley aquifer is part of the larger Miami Valley buried aquifer that serves much of southwestern Ohio. The Miami Valley buried aquifer has been designated a sole source aquifer by USEPA, meaning it is the primary water supply for a significant portion of the population in the region. The Sole Source Aquifer Protection Program is authorized by Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S. Code [USC] 300 et seq.). Federally funded projects that have the potential to contaminate the designated sole source aquifer are subject to USEPA review.

The Mad River well field "wellhead protection area" is the area outlined in the City of Dayton's Well Field Protection Program, and endorsed by the Ohio EPA, within which preventing, detecting, and remediating groundwater contamination is of greatest importance to protect the public water supply. WPAFB has entered into a memorandum of understanding with the City of Fairborn and the City of Dayton to protect the well fields, which requires WPAFB to coordinate with these cities for construction projects within the wellhead protection zone. The Mad River well field wellhead protection zone extends into Area B, including portions of the airfield. A portion of the Downtown District project area, where existing wastewater lines would be replaced, is included in the 10-year recharge zone. None of the rest of the project area is located within the wellhead protection zone.

Water is treated and stored in three 300,000-gallon, ground-level reservoirs near Facility 20085A. Treatment consists of air stripping to remove VOCs; polyphosphate addition to control scale in the air strippers; carbon dioxide addition to control scale in the distribution system; fluoridation; and chlorination. The capacity for treatment is the main limitation to system capacity. The water system has been designed to supply a much larger demand than required by the current base population. The

current estimated production and treatment capacity of the water system in Area B is 4,000 gpm, or about 5.7 million gallons per day (mgd), which is well in excess of the current usage of 1.6 mgd.

Water is supplied to the project area by way of a "high service" distribution system. The water distribution system recently has undergone a near complete upgrade. This system is supplied by pumps in Facility 20085A and the 200,000-gallon elevated water tower near the intersection of Q and 10th streets. This water tower is scheduled to be replaced with a 250,000-gallon tower in FY 2008. The new tower will be 35 feet taller to increase system pressure. The water piping consists of looped mains on a grid system.

3.13.3 Wastewater Collection

Wastewater in the project area is collected in an underground system and routed to the City of Dayton WWTP for treatment. In general, the WPAFB wastewater collection system is designed for a population that is 50 percent larger than the current base population. Ongoing improvements to the sanitary sewer system include upgrades of pump stations and some collection lines. Needed improvements include monitoring and removal of storm water cross connections into the sanitary system.

In the project area, the wastewater collection system is divided into an "L" system, which collects wastewater from the eastern portion of the project area, and an "M" system that collects the western project area. The "M" system serves the downtown area, and therefore a greater proportion of the existing facilities in Area B. Based on the current loads and pipe capacities, the "L" system has a greater excess capacity than the "M" system.

Based on monitoring by the City of Dayton WWTP and modeling of the system for the BRAC design, the estimated total wastewater volume from Area B is about 770,000 gallons per day.

3.13.4 Natural Gas

Natural gas is used for auxiliary heating and various other minor services. Vectren Corporation supplies natural gas to WPAFB by way of several medium-pressure gas connections. The main

serving the project area is along National Road. A number of natural gas distribution lines traverse the project area to supply the existing facilities, which generally follow the existing roadways. In the project area, gas mains run along the east side of Q Street, the north side of 5th Street, both sides of Skyline Drive, and 8th Street west of Skyline Drive.

Portions of the natural gas system are dated and require upgrades. According to the WPAFB General Plan (Woolpert Consultants, 2001), an estimated 7,000 linear feet of older steel and cast iron piping in Area B needs to be replaced over the next several years.

3.13.5 Electrical

Area B receives electricity from the Dayton Power and Light Company by way of the Airway substation located at Kauffman Avenue. Overhead lines to six substations on base supply electrical power to Area B. From these substations, underground cables supply most of the power to facilities . There are some overhead lines in the project area, specifically one near Building 464 that serves Building 675, and one along the east side of Q Street. In general, electrical power supply in Area B has been sufficient and reliable.

3.13.6 Communications

Main communications lines run to “cable huts” and from there, communication connections are distributed to individual facilities. The majority of the Hilltop District is served by the cable hut at Facility 20130, located near the intersection of 5th Street and Skyline Drive. Communications are provided to the individual facilities from the cable hut via underground conduits that generally parallel existing roadways.

3.14 Environmental Justice

The purpose of EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, is to identify, address, and avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations. The area of the Proposed Action is located in Area B. The nearest residences are across National Road, near the Reese Drive intersection. This is primarily apartments associated with Wright State

University. Also located on the far side of National Road is a housing development known as The Woods, privatized housing from WPAFB. Both housing areas may be impacted by any construction-related traffic along National Road during construction. Both should be positively impacted by improved traffic flow with the relocated gate at Reese Drive. Neither population is classified as minority or low income.

The counties in the vicinity of WPAFB have a lower percentage of minority groups than the United States as a whole. These statistics are summarized in Table 7.

TABLE 7
Race and Ethnicity for Greene, Montgomery, Clark, and Miami Counties, Ohio and the United States, 2000

Race/Ethnicity	Greene County	Montgomery County	Clark County	Miami County	United States
White	89.2%	76.6%	88.1%	95.8%	75.1%
Black or African American	6.4%	19.9%	8.9%	2.0%	12.3%
American Indian and Alaska Native	0.3%	0.2%	0.3%	0.2%	0.9%
Asian	2%	1.3%	0.5%	0.8%	3.6%
Native Hawaiian and other Pacific Islander	0.0%	0.0%	0.0%	0.0%	0.1%
Hispanic or Latino[a]	1.2%	1.3%	1.2%	0.7%	12.5%
Other	0.4%	0.5%	0.5%	0.3%	5.5%

Source: US Census Bureau 2000
[a] Persons of Hispanic or Latino origin may be of any race; because of this, the sum of the percentages does not equal 100.

4.0 Potential Environmental Impacts

4.1 Introduction

The purpose of this chapter is to provide an evaluation of the potential impacts associated with the Proposed Action (constructing BRAC infrastructure upgrades and the new HPW complex) and with the alternatives presented in Chapter 2. The No Action Alternative represents the baseline conditions to which the Proposed Action and alternatives are compared. The evaluation of the Proposed Action and alternatives is summarized in Table 3.

4.2 Natural Resources

4.2.1 Vegetation

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Approximately 95 percent of the undeveloped areas within the project area are comprised of maintained lawns or open fields, while less than 5 percent of these areas are wooded or scrubby (dominated by shrubs and small trees). Vegetation throughout the proposed project area would be disturbed and removed during site preparation. Impacts to vegetation in most of the project area would be minor because the vegetation is primarily planted and maintained grass, which is common throughout the base, and does not represent unique or high quality vegetative communities. Areas that are temporarily disturbed areas around proposed pavement and building sites for infrastructure upgrades would be restored with similar vegetation species (for example, grasses) after construction activities are complete.

Vegetation other than maintained grass would be locally affected at a few sites within the project area. Construction of the relocated Gate 19B entrance at Reese Drive and associated roads would require localized removal of a number of trees in a park-like recreational area, and a small amount of scrubby (dominated by shrubs and small trees) vegetation along National Road. Several trees also may be removed north of 5th Street where new storm sewer lines would be located. These storm sewer lines also would remove narrow lines of herbaceous vegetation along two surface drainages in this area. The trees and other vegetation that would be affected in these areas are common to the region. Removal of this vegetation would not affect any unique or high quality habitats.

Given that the vegetation surrounding the project site is largely maintained, no peripheral impacts to adjacent habitats would be expected. None of the project elements would cause fragmentation of any large, contiguous natural habitats.

No Action

Vegetation would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to vegetation under this alternative would be identical to the Proposed Action. While the site-by-site construction would result in a different area of disturbance, the footprint of the construction would ultimately be the same, and therefore the total impact to vegetation would be the same.

The gate would be constructed as a single action as in the Proposed Action. The same area and the same number of trees would be removed at the proposed gate as for the Proposed Action. No impact to unique or high quality vegetative communities would occur. Similar restoration of temporarily disturbed areas would be implemented as for the Proposed Action.

4.2.2 Wildlife

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The wildlife habitat that would be affected by the majority of the Proposed Action is comprised of mowed lawns or grassy areas that are at least occasionally mowed. These areas would be expected to have low wildlife habitat value. Natural habitats that would be affected include removal of an area of trees north of 5th Street, near the Hunter's Lodge (approximately 0.6 acre), and in the construction area of the relocated gate, removal of a portion of the wooded park area west of Q Street and scrub vegetation along National Road (total of about 3 acres). This loss of habitat would displace some resident small mammals and birds, at least during construction, to other similar nearby habitats.

The loss of habitat may contribute to a decline in the resident populations that is commensurate with the area of habitat impact. Recent aerial photography shows approximately 650 acres of wooded

habitats within a 1-mile radius of the project area. Given the relative area of natural (woodland or scrub) habitats that would be affected by the project (about 0.5 percent), no measurable change in the wildlife populations in the project vicinity are expected. Following completion of the construction of the infrastructure upgrades and HPW complex, restoration of the project area with landscaping and similar grass habitats would reduce the impact to these wildlife species.

No Action

Wildlife would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The wildlife habitat affected by this alternative would be identical to the Proposed Action. Similar minor short-term and long-term impacts to wildlife populations would be expected from this alternative. Partial restoration of vegetation after construction would have a similar mitigative effect on wildlife.

4.2.3 Threatened and Endangered Species

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Threatened and endangered species have not been identified within the project area nor during previous surveys has any habitat been identified that could support a population of these sensitive species. USFWS recommends that project designs maintain as many trees and forested habitat as possible along all property lines and along edges of developed area by minimizing the footprint of graded areas, roads, and staging areas to the maximum extent practicable (Appendix C).

The relocated gate area would require removing a number of mature trees, several of which (shagbark hickories) contain characteristics such as loose bark and cavities and which may be suitable as summer roost trees for the Indiana bat (Figure 10). USFWS recommends that if the project area contains trees or associated habitats exhibiting any of the characteristics of Indiana bat summer habitat (Appendix C), the habitat and surrounding trees should be saved wherever possible. The USFWS correspondence requests additional coordination if potential Indiana bat habitat would be affected by the project, to determine if additional surveys were needed to ensure the bat was not

present. A mist netting survey to monitor the known population of Indiana bats at WPAFB occurred in July 2007. This survey included a number of netting sites surrounding the project area, both in Area B to the south and east of the project area, and to the north in Area C. The only Indiana bats identified in these surveys were in Area C, along the Mad River, 1.7 miles or more from the project area.

WPAFB is conducting additional coordination with USFWS regarding the potential Indiana bat summer roost trees. To minimize any potential impacts to the Indiana bat, WPAFB will implement mitigation measures outlined in the INRMP, which have been reviewed and approved by USFWS. These measures include limiting tree cutting to the time when the bats would least likely be present, specifically, from September 15 to April 15. Coordination with USFWS will confirm that the approved seasonal cutting restrictions will avoid impact to this species in the project area. Should USFWS impose additional measures regarding the Indiana bat, WPAFB will implement those as well.

Wetland habitats suitable for the eastern massasauga rattlesnake do not occur in the project area; therefore, no impact to this species is expected.

No Action

Threatened and endangered species would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

This alternative would have similar impacts to trees as the Proposed Action. To avoid any potential impacts to the Indiana bat, seasonal tree cutting guidelines would be followed as discussed above. No other threatened or endangered species would be impacted.

4.2.4 Wetlands

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Wetlands B10, B1, B2, B3, B5, B7, B11, and B12 are located adjacent to areas designated to receive infrastructure upgrades and HPW complex construction. However, based on available designs

provided to date (that is, *35% Request for Proposal (RFP) Design of the HPW Complex* [KZF/BWSC, 2007a], *100% RFP Submittal* [KZF/BWSC, 2007b], and *Requirements Document FY 2007 BRAC Site Design and Utilities Infrastructure Upgrade* [KZF/BWSC, 2006]), none of the 17 wetlands identified in Area B during the 2005 WPAFB wetland delineation, including the ones not shown on Figure 11, would be impacted by the construction of infrastructure upgrades and the HPW complex.

Based on the preliminary design, the relocated Gate 19B portion of the Proposed Action would affect two small wetlands (totaling 0.06 acre). Both of these wetlands are Ohio EPA Category 2 wetlands. The gate relocation also would affect approximately 540 linear feet (0.14 acre) of streams, for a total impact of about 0.2 acre to waters of the United States. Under Section 404 of the CWA, these impacts to wetlands and streams would require a permit from USACE.

In recent correspondence, the two drainages north of 5th Street also have been determined by USACE to be "relatively permanent waters" and are considered regulatory waters under the CWA; therefore, proposed impacts to these drainages as part of proposed storm water improvements and HPW complex construction also would require a permit from USACE.

WPAFB is currently pursuing an individual Section 404 permit from USACE and a Section 401 Water Quality Certification from the Ohio EPA that will address the impacts to streams and wetlands from this project.

The Section 404 and 401 permits would require mitigation for the affected wetlands. Normally, wetlands are mitigated through restoration, replacement, or enhancement at a minimum ratio of 1.5:1. As mitigation for unavoidable impacts to wetlands at the relocated gate location, WPAFB has submitted to USACE a preliminary plan for enhancement of Wetland B1 (0.99 acre, Ohio EPA Category 2), located in Area B along Loop Road (Figure 11). That plan is under review by USACE. Typical approved USACE compensatory mitigation measures for enhancement of a wetland that could be implemented at Wetland B1 include removing invasive exotic vegetation, enhancing

aquatic resources, debris removal and shoreline stabilization, and possible introduction of more appropriate wetland native vegetation. The final plan would conform to the USACE Mitigation Guidelines and Checklist for the State of Ohio (September 23, 2004) (Appendix D). In particular, the mitigation plan would follow the compensatory mitigation guidelines set out in Section IV.C of that document.

No Action

Wetlands would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impact to wetlands and streams from this alternative would be essentially identical to those of the Proposed Action. As with the Proposed Action, these improvements would require coordination with USACE and the Ohio EPA to confirm the extent of wetlands affected and the appropriate mitigation. Consultation currently underway with USACE and Ohio EPA regarding the wetlands encompasses the necessary permits and compensatory mitigation that would be required under this alternative as well. Mitigation for wetlands loss would conform to the USACE Mitigation Guidelines and Checklist for the State of Ohio (September 23, 2004) (Appendix D). In particular, the mitigation plan would follow the compensatory mitigation guidelines set out in Section IV.C of that document.

None of the 17 wetlands identified in Area B during the 2005 WPAFB wetland delineation, including the ones not shown on Figure 11, would be impacted by the construction of infrastructure upgrades and the HPW complex.

4.3 Water Resources

4.3.1 Groundwater

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The infrastructure upgrades and HPW complex construction may require partial burial and/or complete burial of utilities. Groundwater quality in the Hill aquifer occurring at 9 to 15 feet bgs would not be expected to be impacted significantly by these activities. Turbidity may increase, but would not be expected to continue after construction completion. No other potential groundwater

impacts have been determined; therefore, infrastructure upgrades and facility construction at the proposed location are not expected to significantly impact groundwater resources.

No Action

Under the No Action Alternative, impacts to groundwater resources would not be expected.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The infrastructure upgrades in this alternative would require partial burial and/or complete burial of utilities as for the Proposed Action. As with the Proposed Action, groundwater quality in the Hill aquifer occurring at 9 to 15 feet bgs would not be expected to be impacted significantly by these activities. Similar to the Proposed Action, infrastructure upgrades under this alternative are not expected to significantly impact groundwater resources.

4.3.2 Surface Water

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

It has been calculated that completion of the infrastructure upgrades and the HPW complex would yield a site with 70 percent of its area having impervious surfaces (buildings, roadways, walks, parking lots, etc.). This would create a substantial increase in storm water runoff that the existing storm sewer system cannot hold. Preliminary storm water runoff calculations indicate the existing storm runoff volume is approximately 70 ft^3 per second versus 210 ft^3 per second for the proposed completed HPW complex. Storm water runoff for this project area flows northerly toward an existing south to north ditch that goes along the west end of the existing heating plant, Facility 20770 (north of the intersection of Kauffman Avenue and Q Street). This ditch outfalls to an unnamed creek that is between Kauffman Avenue and SR 444. This unnamed creek is heavily vegetated, flows easterly past Facility 20770 and eventually turns and meanders north to Hebble Creek and ultimately to the Mad River. The majority of the runoff from the project area flows northerly within NPDES Area 5 that eventually flows to the unnamed creek. Only the western portion of the project area flows westerly through NPDES Area 3 (this goes down the hill to the Downtown District of Area B).

The Proposed Action includes installing a new underground storm sewer network. New storm water piping would replace two open drainages identified in the HPW complex area north of 5th Street, and lead to a dry detention basin north of 1st Street to retain the approximately three-fold increase anticipated in storm water runoff from the project area. The detention basin would be designed to drain empty within 48 hours.

As discussed in Section 4.2.4, new storm water piping and a detention basin would replace two open drainages identified in the HPW area, and construction of the relocated gate would require crossings of three small streams. These waters may be regulated as "waters of the United States," and impacts to them would require a permit under Section 404 of the CWA. USACE has made a preliminary jurisdictional determination that encompasses the two drainage ditches and the small streams and wetlands at the gate area. USACE is reviewing documentation for a jurisdictional determination but is proceeding under the assumption that an individual Section 404 permit is required for this project overall. Should USACE decide that some of the streams are not jurisdictional, WPAFB will comply with applicable permit requirements**.** WPAFB has contacted Ohio EPA and submitted preliminary paperwork, although Ohio EPA typically does not process the Section 401 permit application until USACE has completed its jurisdictional determination.

Like wetlands, both USACE and Ohio EPA require mitigation for stream impacts as part of the permitting process. In accordance with current policy, stream mitigation is typically required on a linear foot replacement basis. Alternative mitigation approaches that will compensate for the function of the impacted water also are possible. For this project, the development of the stream mitigation plan of regulated waters is dependent on the final jurisdictional determination by USACE. WPAFB will work with USACE and Ohio EPA to develop a stream mitigation plan that is acceptable to both agencies.

WPAFB storm water drainage to the Mad River is monitored under provisions of the NPDES. An NPDES permit places limits on the levels of certain pollutants that may be discharged into water bodies. Pollutants regulated at individual outfalls at WPAFB include benzene, toluene, ethylbenzene,

and xylenes (BTEX); suspended solids; metals; oil and grease; and pH. It is anticipated that there would be a three-fold increase in storm water runoff from Area B as a result of the proposed construction of the BRAC facilities. As a result, a dry detention basin has been proposed. The proposed location of the detention basin is on the north side of 1st Street in an existing maintenance yard area. Preliminary information indicated that the design would be sufficient to retain additional runoff (minimum of 215,000 ft^3, 232 feet by 232 feet by 4 feet deep).

Because construction of the infrastructure upgrades and HPW complex would disturb more than 1 acre of land, an NOI application must be submitted by the construction contractor to Ohio EPA prior to any soil being disturbed. The NOI application and fee must be submitted to the Environmental Management Division for review and submission to Ohio EPA. The NOI application must include a site-specific Storm Water Pollution Prevention Plan that addresses erosion control measures, such as a construction access drive, storm sewer inlet protection, and silt fencing; best management practices; and maintenance and inspection procedures that will be followed. In addition, a modification to the NPDES permit may be appropriate to cover new potential outfalls and discharges, such as from the detention basin. While NPDES permits principally address storm water runoff from industrial processes, it may be that Ohio EPA would want to review this issue during the upcoming WPAFB NPDES permit renewal period in the fall of 2008/spring of 2009.

If any hazardous substance is released into a waterway on WPAFB, the spill must be reported by calling 911 immediately. If 1 gallon or more of a hazardous substance is released to the environment, it also must be reported immediately by calling 911. The number to call WPAFB 911 using an off-base phone is 257-9111.

During construction, the soil throughout the site would be disturbed and exposed to erosion. Therefore, until the re-establishment of vegetative cover, erosion control measures would be implemented in accordance with base specifications for construction projects and the project-specific NPDES Storm Water Pollution Prevention Plan that must be filed by the contractor with the Ohio EPA prior to construction as part of the NOI application under the Ohio General Construction Permit

for any construction project that is disturbing more than 1 acre of land. Soil erosion and siltation control measures could include the use of silt fencing, hay bales, and/or hydro-mulching in and adjacent to construction areas. .

No Action

Under the No Action Alternative, impacts to surface water resources would not be expected.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to surface water under this alternative would be similar to the Proposed Action. Small spills that do not impact the environment and are cleaned up by the contractor must be documented and reported to the Environmental Management Division. This documentation is used to record the nature of the spill and to help determine trends and ways to prevent future spills. If any hazardous substance is released into a waterway on WFAFB, the spill must be reported by calling 911 immediately. If 1 gallon or more of a hazardous substance is released to the environment, it also must be reported immediately by calling 911. The number to call WPAFB 911 using an off-base phone is 257-9111.

During construction, the area of disturbed soil throughout the site would be expected to be larger than the Proposed Action because more project work would be occurring in parallel. As a result a larger portion of disturbed soil would be exposed for potential erosion. As for the Proposed Action, an NOI and a Storm Water Pollution Prevention Plan would still be required, and erosion control measures would be implemented in accordance with them.

WPAFB storm water drainage to the Mad River is monitored under provisions of the NPDES permit. An NPDES permit places limits on the levels of certain pollutants, primarily from industrial processes, that may be discharged into water bodies. Pollutants regulated at individual outfalls at WPAFB include BTEX, suspended solids, metals, oil and grease, and pH. It is anticipated that there would be a three-fold increase in storm water runoff from Area B as a result of the proposed construction of the BRAC facilities. As a result, a dry detention basin has been proposed. The

proposed location of the detention basin is on the north side of 1st Street in an existing maintenance yard area. Preliminary information indicated that the design would be sufficient to retain additional runoff (minimum of 215,000 ft^3, 232 feet by 232 feet by 4 feet deep). Because construction of the infrastructure upgrades and HPW complex would disturb more than 1 acre of land, an NOI application must be submitted by the construction contractor to Ohio EPA prior to any soil being disturbed.

The NOI application and fee must be submitted to the Environmental Management Division for review and submission to Ohio EPA. The NOI application must include a site-specific Storm Water Pollution Prevention Plan that addresses erosion control measures, such as a construction access drive, storm sewer inlet protection, and silt fencing; best management practices; and maintenance and inspection procedures that will be followed. In addition, a modification to the NPDES permit may be appropriate to cover new potential outfalls/discharges, such as from the detention basin. While NPDES permit principally address stormwater runoff from industrial processes, it may be that Ohio EPA would want to review this issue during the upcoming WPAFB NPDES permit renewal period in the fall of 2008/spring of 2009.

As discussed in Section 3.3.2, new storm water piping would replace the two open drainage ditches identified in the HPW area, and construction of the relocated gate and associated roads would require modification and/or filling in of the small streams identified in that area. The open drainages located in the HPW complex area and the streams located in the gate area would be filled in due to infrastructure upgrades and facility construction. These streams may be classified as “waters of the United States” according to Section 404 of the CWA. WPAFB has coordinated with USACE for a jurisdictional determination. USACE has made a preliminary jurisdictional determination that encompasses the two drainage ditches and the small streams and wetlands at the gate area. They have issued a Public Notice with the maximum proposed impacts. WPAFB has submitted a preliminary mitigation plan to compensate for the proposed impacts, which includes enhancing an existing 0.99-acre wetland, known as Wetland B1, located along Loop Road near Gate 22B. That plan is under review. Should USACE decide that some of the streams and/or wetlands are not

jurisdictional, and WPAFB needs to seek an isolated wetlands Section 401 permit from Ohio EPA, WPAFB will comply with applicable permit requirements**.** WPAFB has contacted Ohio EPA and submitted preliminary paperwork, although Ohio EPA typically does not process the Section 401 permit application until USACE has completed its jurisdictional determination.

4.3.3 Floodplain

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The elevation of the areas receiving infrastructure upgrades and the new HPW complex within Area B (935 to 950 feet msl) is above the Mad River 100-year floodplain elevation (814.3 feet msl). A reduction of floodplain management capacity would not be impacted by the construction of the infrastructure upgrades and the HPW complex. The infrastructure upgrades and facility construction within the project area would increase storm water runoff; however, the additional storm water runoff is expected to be managed by the proposed dry detention basin, which would reduce substantial flow into the Mad River during rain events. Therefore, no short-term or long-term impacts within the project area associated with the BRAC infrastructure upgrades and HPW complex construction were identified.

No Action

Floodplain management would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to floodplains under this alternative would be identical to the Proposed Action. The elevation of the areas receiving infrastructure upgrades and HPW complex construction within Area B (935 to 950 feet msl) is above the Mad River 100-year floodplain elevation (814.3 feet msl), and a reduction of floodplain management capacity would not be impacted by the construction. The infrastructure upgrades and facility construction within the project area would increase storm water runoff; however, the additional storm water runoff is expected to be managed by the proposed dry detention basin, which would reduce substantial flow into the Mad River during rain events. Therefore, no short-term or long-term impacts within the project area associated with the construction of the infrastructure upgrades and HPW complex were identified.

4.4 Hazardous Materials/Waste, Stored Fuels, and Installation Restoration Program

4.4.1 Hazardous Materials/Waste

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

During construction of the BRAC infrastructure and HPW complex, all construction would conform to OSHA requirements such as described by the *OSHA Guidance Manual for Hazardous Waste Site Activities, Standard Operating Safety Guides* (USEPA 1992), and Safety and Health Regulations for Construction (29 CFR 1926). Health and safety plans would be developed and would include environmental exposure monitoring. Construction contractors would maintain compliance with all environmental regulations and permits that apply to the work being performed. Periodic environmental health and safety monitoring may be needed to verify that employees are protected and exposure limits are not exceeded. Each contractor would maintain an OSHA 200 log.

Pollution source reduction techniques and prevention strategies, as appropriate, recommended by USEPA's Office of Pollution Prevention, would be incorporated into the design of proposed projects. If unexpected conditions are encountered during construction, work would stop, and the appropriate environmental and health protection actions would be taken in accordance with project specifications. To mitigate for potential impacts associated with future construction and to protect human health and the environment, the following general actions would be performed:

- All materials (hazardous and nonhazardous) and wastes generated from construction activities would be handled, stored, and disposed in accordance with applicable federal, state, and local regulations.
- Strict contract specifications would be established for construction contractors requiring proper management and disposal of materials and waste.
- Waste generation would be minimized to the extent possible.
- Excavated soil would be used as fill material, as appropriate.
- Procedures, plans, and programs would be developed to prevent risk to workers and public health, which could result from exposure to HAZMAT, contaminated soils, and HW.

- Proper storage and containment structures would be provided for HAZMAT so that hazardous constituents are not released to the environment.
- Health and safety plans would be developed by all construction contractors to address potential hazards, including potentially contaminated soils, under the guidance of a recognized safety and health professional.
- Access to the construction sites would be controlled with security gates and fencing.

Wastes typically generated during construction include lumber, concrete, metal, glass, plastics, solvents, and empty containers. Local contractors would be required to comply with federal, state, and local requirements for waste classification, record keeping, reporting, and disposal. During construction, contractors would be required to develop a Construction Management Plan that would include measures to be employed if drums or contaminated soil and groundwater were encountered, or required management or disposal. Stationary fuel tanks would have secondary containment and would be managed so that spills are prevented. HAZMAT containers would have proper labeling as required under OSHA's Hazard Communication Standard. Spill Prevention and Response Plans would be developed and implemented. Material safety data sheets would be available for review. The construction contractor would be responsible for the proper identification, containerization, labeling, storage, and disposal of HAZMAT and regulated wastes generated during construction. HAZMAT and other regulated wastes generated by the construction contractor would be disposed by WPAFB. Handling and storage of HAZMAT would be performed in accordance with the manufacturer's specifications and WPAFB specifications. In general, it is anticipated that HAZMAT handled and wastes generated during operations at WPAFB would be minor and consistent with baseline conditions already occurring.

The HPW complex would consist largely of research laboratories which will use various HAZMAT as mentioned previously. The exact quantities of HAZMAT to be purchased, used, and stored in the HPW complex is not known at this time; however, based on historical waste generation activities of the incoming organizations, it is estimated that Area B HAZMAT purchase, usage, and storage will increase by at least 40 percent. It also has been calculated based on historical waste generation

activities of the incoming organizations that the generation of hazardous, nonhazardous, and universal wastes will increase approximately 40,000 pounds per year. This is a 40 percent increase in the total wastes currently generated at WPAFB. The increased quantities of HAZMAT and increased generation of wastes will have a long-term impact not only to the environment, but also to the manpower and operations of the Environmental Management Division. As a result, a request for two additional contract support positions has been requested to support the HAZMAT program. To accommodate the increased generation of wastes, a new 1,600 ft^2 HW storage facility has been proposed to be constructed at WPAFB. Construction of the HW storage facility will be evaluated in a subsequent EA.

No hazards will be associated with the potential demolition of Facility 20430. An environmental survey was conducted at Facility 20682 in June 2007 to identify hazardous substances. There would be no negative environmental impacts from demolition of this facility because a survey has been accomplished to identify the HAZMAT, and hazardous substances would be handled and disposed of in compliance will all applicable regulations prior to demolition activities.

No Action

The No Action Alternative would have no impact on stored fuels, HAZMAT, or HW.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to HAZMAT or HW under this alternative would be identical to the Proposed Action. No HAZMAT would be associated with the potential demolition of Facility 20430. Potential wastes associated with the potential demolition of Facility 20682 (hazardous, PCBs, asbestos, and lead) would be removed and disposed in compliance will all applicable regulations prior to demolition activities. The infrastructure upgrades, facility construction, and demolition activities would have a long-term impact to the environment and operations and manpower of the Environmental Management Division at WPAFB.

4.4.2 Stored Fuels

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Multiple generators for the HPW complex (combined north and south) are estimated to have a total capacity of 3,000 kW. The associated generator fuel tanks would hold enough fuel for 24 hours of full operation. Since the HPW complex is still early in the design phase, generator and fuel tank specifications have not been provided to the base for determination of any applicable SPCC requirements. As soon as they are available for review, the Environmental Management Division will make the applicable regulatory determinations and ensure that any regulatory requirements are adhered to.

No Action

The No Action Alternative would have no impact on stored fuels.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts from stored fuels would be the same under this alternative as they are under the Proposed Action, though it would occur one generator at a time. The Environmental Management Division would ensure that applicable SPCC requirements are met.

4.4.3 IRP Sites

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Several of the OU9 IRP sites (EFDZs 2, 3, 4, 6, 7, and 8) are located adjacent or within roadways that may be resurfaced or replaced or near the location of the HPW complex (Figure 10). According to information in the *Land Use Control Plan* (Shaw, 2006), digging, construction, and other soil disturbances are allowable within these IRP sites after approval by Base Civil Engineering and Environmental Management Division personnel. Minor short-term impacts (that is, soil disturbance) could occur during roadway resurfacing or replacement. No long-term impacts would be expected.

No Action

The No Action Alternative would have no impact on the IRP sites.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts under this alternative would be expected to be the same as those for the Proposed Action. Minor short-term impacts (that is, soil disturbance) could occur during roadway resurfacing or replacement in the vicinity of EFDZs 2, 3, 4, 6, 7, and 8. No long-term impacts would be expected.

4.5 Land Use

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

As stated in Section 3.5, current land use in the project area is classified research and development, community service, administrative, community commercial, open space, and outdoor recreation. The Proposed Action would have no impact on land use in the Downtown District and the majority of the Hilltop District. In the location of the HPW complex, land us designation would change from open space to research and development. This change in land use is consistent with land use plans outlined in the WPAFB General Plan (Woolpert, 2001), which indicates that research and development functions characterize land use in Area B. The future land use plan has been to consolidate research and development into discrete campus environments to increase efficiency. Therefore, no negative impact is associated with a change in land use designation to research and development in the Hilltop District.

Although land use designation would not change in the vicinity of the proposed relocated entrance gate, there would be minor impacts to the recreational use in this area. Construction of the new roadway into the base would bisect the parcourse fitness trail in this area. Once the relocated gate and entrance road are complete, the parcourse would become in effect two parcourses. This is a minor impact overall. In addition, the park-like setting would be slightly diminished with the removal of several mature trees in this area.

No Action

The No Action Alternative would have no impact on land use.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to land use under this alternative would be identical to the Proposed Action. There would be no impact on land use in the Downtown District. Land use designation in the Hilltop District would be changed from open space to research and development. This change in land use designation is consistent with the future land use plan for Area B as outlined in the WPAFB General Plan (Woolpert, 2001).

Although land use designation would not change in the vicinity of the proposed relocated entrance gate, there would be minor impacts to the recreational use in this area. Construction of the new roadway into the base would bisect the parcourse fitness trail in this area. The parcourse would become two smaller fitness trails. In addition, the park-like setting would be slightly diminished with the removal of several mature trees in this area.

4.6 Soil

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Preparing the site prior to construction would require minimal leveling. Approximately 80 soil borings were performed in 2007 within the project area (KZB/ BWSC, 2007b). The geotechnical data indicated that bedrock exists as shallow as 1.3 feet, which would require manual removal of rock (blasting not allowed).

It is anticipated that the building foundations for the HPW complex will range from 8 to 13 feet below grade, and the utilities will be installed below grade approximately 5 to 6 feet. The HPW complex area has existing ground slope that falls northerly from the existing southern parking lots (across from Facilities 20643 and 20641) up to 1st Street. This site has a fall of approximately 100 feet. The building layout being investigated with the concurrent site planning is taking into account the potential for stepping the buildings to allow proper access and avoid substantial earthwork.

Surface soil within the project area is composed primarily of silt to clayey loams; as a result, there would be a continuous potential for erosion. Therefore, until vegetative cover could be re-established, erosion control measures in accordance with the site-specific Storm Water Pollution

Prevention Plan submitted with the NOI for construction projects would be implemented. Soil erosion and siltation control measures could include the use of silt fencing, hay bales, and/or hydro-mulching in and adjacent to construction areas.

In accordance with OSHA requirements, any open trenches where workers may be entering would need to be shored for side support to prevent collapse. Base contractors for the proposed infrastructure upgrades and HPW complex construction also would be responsible for complying with standard operating procedures and applicable health and safety regulations.

As a result of the construction activities, there would be a potential short-term minor impact to soils during site preparation and excavation activities. Impacts would be minimized through implementation of erosion and siltation controls.

No Action

Soil would not be impacted under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The impacts to soil under this alternative would be similar to the Proposed Action. Preparing the site prior to construction would require minimal leveling. Approximately 80 soil borings were performed in 2007 within the project area (KZB/ BWSC, 2007b). The geotechnical data indicated that bedrock exists as shallow as 1.3 feet, which would require manual removal of rock (blasting not allowed). The excavations for this action would not be expected to impact subsurface soil unless a leak from the construction equipment would occur.

Surface soil within the project area is composed primarily of silt to clayey loams; as a result, there would be a continuous potential for erosion. Therefore, until vegetative cover could be re-established, erosion control measures identified in the site-specific Storm Water Pollution Prevention Plan submitted with the NOI for construction projects would be implemented. Soil

erosion and siltation control measures would include the use of silt fencing, hay bales, and/or hydro-mulching in and adjacent to construction areas.

In accordance with OSHA requirements, any open trenches where workers may be entering would need to be shored for side support to prevent collapse. Base contractors for the proposed infrastructure upgrades also would be responsible for complying with standard operating procedures and applicable health and safety regulations.

As a result of the construction activities, there would be a potential short-term minor impact to soils during site preparation and excavation activities. Impacts would be minimized through implementation of erosion and siltation controls.

4.7 Cultural Resources

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Cultural resources that are listed or eligible for listing on the NRHP are protected from unnecessary harm by the National Historic Preservation Act. Section 106 requires federal agencies to consider the effects of their actions and undertakings on these resources, and to avoid, minimize, and mitigate any effects whenever possible. Undertakings that could change in any way the characteristics that qualify the property for inclusion in the NRHP, for better or for worse, are considered to have an "effect."

Undertakings that do not meet the "no effect" criteria are divided into low-level and high-level impact projects. Low-level impact projects include shallow, ground-disturbing activities such as landscaping. High-level impact projects include more substantial ground-disturbing activities, such as construction for new underground lines, construction of new roads and paved surfaces, temporary access roads to work sites, and the grading and regrading of existing terrain. It is anticipated that the building foundations for the new HPW complex in the Hilltop District will range from 8 to 13 feet below grade. It is proposed that utilities will be installed below grade approximately 5 to 6 feet. By definition, these actions are considered high-level impact projects. Figures 3 and 5 through 10 are detailed maps of the proposed individual infrastructure system upgrades.

The Area of Potential Effect (APE) for the Proposed Action considers all areas that may be disturbed by construction activities, as well as potential effects to adjacent properties surrounding the construction sites; therefore, the APE for the Proposed Action includes the entire project area shown on Figure 13. The larger project area, which would include infrastructure system (utility and road) upgrades, two building demolitions, site preparation and construction of the HPW complex, and relocation of Gate 19B, borders the eastern edge of the Wright Field Historic District and encompasses the Adena mound (Site 33 GR 31).

The majority of the proposed improvements in the Proposed Action, however, would qualify under the "no effect" criteria, simply because they will not occur in the vicinity of any cultural resources. The Hilltop District and the majority of the built area in Area B have been surveyed or determined to have a low likelihood of containing archaeological artifacts because of past disturbance. Furthermore, no historic buildings would be directly affected by these actions. Facilities 20430 and 20682, which are proposed to be demolished, have been evaluated and determined ineligible for NRHP listing and are not part of any historic landscape or district.

The Hilltop District project area does encompass the Adena mound (Site 33 GR 31; Figure 13). Two elements of the Proposed Action will occur in the vicinity of the mound:

- Roadway improvements—Improvements are proposed along Hobson Way from 5th Street to 13th Street. Options for improving Hobson Way include widening to the west of the existing centerline, with adjacent sidewalks; widening to the east of center, with sidewalks; or only partial widening to provide a left turn lane, with no improvements west of Hobson Way in the area of the Adena burial mound site.
- New water "loop" line—The proposed water loop line around the Hilltop District will extend along the west side of Hobson Way from 5th Street to 9th Street, before turning east at 9th Street. This section of the line will be located on the west side of Hobson Way at least 50 feet from the Adena mound (Figure 6).

An archaeological survey was conducted in the vicinity of the Adena mound in 1991 and found no artifacts in the area surrounding the mound (WPAFB, 2006a). To date, no federally recognized tribes have communicated interest in the mound or any other historic property on WPAFB. The proposed construction will approach no closer than 50 feet from the mound; therefore, no impacts to this resource are expected.

The following protective measures will be followed to ensure the Adena mound will not be impacted by construction activities:

- Prior to the start of any work, the Cultural Resources Manager (CRM) will conduct a site visit at the mound with the construction contractor to identify its location.
- Prior to the start of any work, the CRM will install stakes and caution tape with a buffer zone of 40 feet around the mound to notify workers not to cross the tape.
- Once construction work begins, the CRM will conduct weekly inspections at the mound to ensure work does not encroach upon the buffer zone or the mound.

In the Downtown District project area, wastewater lines will be replaced. Approximately 350 feet and 525 feet of sanitary lines along F and G streets, respectively, would be removed and upgraded with new lines in the existing locations. The work would be performed along existing roadways, existing parking lot areas, or in grassed lawn areas between parking and roadways. Since the new lines would be installed in the existing sanitary trenches, it is unlikely that any archaeological resources would be discovered or impacted since it is an existing disturbed area. This work would be located in the Historic District near several eligible facilities (Figure 7). The replacement pipes would be installed with no direct impacts to the historic structures, and disturbed areas would be restored to their current condition after construction. There would be minor construction traffic disturbance in the Wright Field Historic District, but there would be no adverse impacts.

WPAFB has coordinated with the Ohio SHPO regarding the Proposed Action (Appendix E). On April 13, 2007, WPAFB sent an advance notification letter to the informing it of the pending BRAC actions and associated EAs. SHPO responded on June 14, 2007, acknowledging the actions. On

August 17, 2007, WPAFB sent a letter to SHPO requesting a concurrence of no adverse affect on historic properties resulting from the actions evaluated in this EA. On September 5, 2007, SHPO concurred with the finding that the proposed work will have no adverse effect on historic properties provided that the protective measures outlined above for construction near the Adena mound are implemented. SHPO also concurred that the construction of the HPW facilities will conform to the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and have no adverse effect on historic properties.

Should inadvertent discoveries of cultural resources occur during any ground-disturbing activities, the work will immediately cease and the base CRM will be notified. The procedures for inadvertent discoveries outlined in Section D.2.4 in WPAFB's ICRMP, May 2006, which include SHPO notification, will be followed. In addition, the construction contractor will be made aware of WPAFB procedures prior to the start of any construction activities.

No Action

There would be no impacts to cultural resources under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Phased construction of the improvements would have similar impacts to cultural resources as the Proposed Action because the footprint, methods of construction, and final site condition of the improvements would be the same as the Proposed Action.

4.8 Air Quality

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

In the short term (during construction), there would be localized negative impacts to air quality from the Proposed Action. Impacts to air quality from construction activities would include the generation of fugitive dust and particulates from building demolitions, the removal and grading of soil, excavation operations, and other associated construction activities.

OAC 3745-17-08, *Restriction of Emission of Fugitive Dust*, specifies that buildings or roads may not be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Mitigation measures to reduce fugitive dust would be implemented during demolition and construction in accordance with this regulation. Typical mitigation measures to control the fugitive dust include the use of water or other suitable dust suppression chemicals.

Calculations were made to estimate the amount of fugitive dust that would be generated by the project during construction, which considers the area of soil that is exposed to the wind and construction traffic at one time, and the length of time it is exposed. These calculations were performed using USEPA emission factors for heavy construction operations (USEPA, 1995). The estimated area for the overall project is 2,200,000 ft^2 (50.5 acres). Infrastructure upgrades are scheduled to begin fall of 2007 with the relocation of Gate 19B. Estimated completion for the Infrastructure MILCON is spring of 2009. Construction of the HPW complex is scheduled to begin in the spring of 2008. Completion of the HPW complex is scheduled for completion in the spring of 2011. It was assumed that by 2009, the foundations of the HPW complex would be in place and earth moving activities would be limited from this point forward. For the purposes of calculating impacts from fugitive dust, it was assumed that construction would last for 12 to 15 months.

Based on a worst-case scenario for all construction activities, which assumes that all 50.5 acres would be exposed for the entire construction period, it is estimated that the particulate emissions would be 125.6 tpy. Assuming only 20 percent of the area will be exposed at any one time for a period of 6 months, the estimated emissions would be 11.9 tpy. This amount is approximately 60.5 percent of the estimated normal baseline (19.68 tpy) at WPAFB (WPAFB, 2006b). These calculations assume that 80 percent of the particulates will be controlled using the mitigation measures described above. Fugitive dust emissions calculations and assumptions for the calculations are provided in Appendix F.

In either scenario, these calculated emissions would exceed the de minimis particulate emission thresholds of 10 pounds per day and 5 tpy established by Ohio EPA (OAC 3754-15-05). To meet these limits, WPAFB would implement further controls to limit fugitive dust, which could include limiting the area exposed at one time. As needed, WPAFB will coordinate with Ohio EPA to amend the Title V permit to allow for increased emissions during construction activities.

The VOC and/or NO_x emissions (if any) from fuel combustion in construction equipment would be expected to be negligible and do not warrant a detailed emissions estimation. The VOC and NO_x emissions would be below the de minimis emission levels area of 50 tpy for VOCs and 100 tpy for NO_x, and thus, in accordance with 40 CFR 93.153(c)(1), a conformity determination is not required.

Multiple generators for the HPW complex (combined north and south) are estimated to have a total capacity of 3,000 kW. The associated generator fuel tanks would hold enough fuel for 24 hours of full operation. Since the HPW complex is still early in the design phase, generator and fuel tank specifications have not been provided to the base for determination of any applicable air permit requirements. As soon as they are available for review, the Environmental Management Division will make the applicable regulatory determinations.

The current daily steam load from Facility 20770 to existing structures is approximately 175,000 pounds of steam per hour. The anticipated increase to provide steam to the HPW complex is 60,000 pounds of steam per hour, for a total anticipated hourly load of 235,000 pounds of steam per hour. Even at this output, none of the Title V permit limits would be exceeded. Estimated increases in emissions from Facility 20770 are provided in Appendix F.

No Action

No impacts to air quality would occur under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts under this alternative would be expected to potentially still exceed the 5 tpy de minimis threshold, but would depend on the proposed construction schedule and the area exposed at one time.

4.9 Noise

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The project area is located in the less than 65 dB and 65 to 70 dB current operations noise contours. Should the mission increase in the future, the noise levels may increase in Area B to 65 to 70 and 70 to 75 dB.

During implementation of the infrastructure upgrades and construction of the HPW complex, there would be minor, negative short-term impacts on ambient noise levels in the project area from the operation of heavy machinery and equipment. Heavy equipment such as bulldozers, graders, backhoes, excavators, and dump trucks would generate noise that could affect the construction workers. Construction equipment typically emits noise in the 86 to 94 dB range. Several examples of noise levels in dBA are listed in Table 8. Heavy duty trucks generate a noise level of approximately 90 dBA (very loud) at 50 feet. Attenuation to 65 dBA (moderately loud) would occur at a distance of approximately 800 to 1,000 feet depending on climatic conditions, topography, vegetation, and man-made barriers (Generac Power System, Inc., 2004, as cited in USAF, 2007).

Construction workers would use hearing protection and would follow OSHA standards and procedures. Onsite workers in the nearby facilities would experience short-term, intermittent muffled noise during the workday. Residences in the vicinity of National Road also would experience some short-term, intermittent muffled noise during the workday when road improvements near the proposed new entrance into the base are being implemented. This intermittent exposure could be a nuisance, but would not pose a threat to hearing.

TABLE 8
A–Weighted (dBA) Sound Levels of Typical Noise Environments

dBA	Overall Level	Noise Environment
120	Uncomfortably loud (32 times as loud as 70 dbA)	Military jet takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet
90	Very Loud	Heavy-duty truck, average traffic
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet Diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge Vacuum cleaner (indoor)
65	Moderately loud	Gas powered generator
60	Relatively quiet (1/2 as loud as 70 dBA)	Air condition unit at 10 feet Dishwasher at 10 feet (in door)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers Small private office (in door)
40	Very quiet (1/8 as loud as 70 dBA)	Bird calls Lowest limit of urban ambient sound
10	Extremely quiet (1/64 as loud as 70 dBA)	Just audible
0	Threshold of hearing	

Source: Wyle Research Corporation 1992

Once construction of the infrastructure upgrades and HPW complex is complete, noise associated with construction activities would cease. WPAFB does not foresee any long-term noise impacts as a result of HPW complex operations.

No Action

There would be no impacts under the No Action Alternative, as no construction-related noise would be generated.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts under this alternative are be expected to be similar to those under the Proposed Action, though of less intensity over a longer duration. There would be minor, negative, short-term impacts

on ambient noise levels due to the operation of heavy machinery and equipment in the area where infrastructure upgrades and facility construction would be taking place. Construction workers would use hearing protection and follow OSHA standards and procedures. Onsite workers in the nearby facilities would experience short-term, intermittent muffled noise during the workday. Residences in the vicinity of National Road also would experience some short-term, intermittent muffled noise during the workday when road improvements near the proposed relocated entrance into the base are being implemented. This intermittent exposure could be a nuisance, but would not pose a threat to hearing.

Upon completion of the infrastructure upgrades and HPW facility construction, noise associated with construction activities would cease. WPAFB does not foresee any long term noise impacts as a result of HPW complex operations.

4.10 Health and Safety

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

Because construction workers conducting the infrastructure upgrades and HPW facility construction would be responsible for complying with standard operating procedures and applicable health and safety regulations, no impacts to health and safety would be expected. There are existing active and/or abandoned utility lines (primarily steam lines) that have asbestos associated with them. The "B" line between 10th and 7th streets is the only active steam line that is questionable for asbestos insulation. Abandoned steam lines with asbestos insulation include the run along the east side of Q Street north of 5th Street, the run on the north side of 5th Street east of Q Street, and the feed line to Building 676 from the steam pit beside Building 675. There is a remote possibility of some water lines having asbestos coating. All applicable health and safety regulations would be followed during the removal and/or replacement of these lines, if necessary.

Prior to excavating soil and installing utilities associated with the infrastructure upgrades and facility construction, digging clearances would be obtained from Base Civil Engineering and Base Utilities. As discussed in Section 3.10, some roadways (for example, Skyline Drive) that would be resurfaced or replaced lie within the boundary of several IRPs (that is, EFDZ 4, 7, and 8). These IRP sites have

no digging restrictions associated with them; however, soil disturbing activities must be approved by Base Civil Engineering and Environmental Management Division personnel.

Impacts to health and safety of nearby personnel would be minimized by clearly identifying the construction zone and prohibiting access to unauthorized individuals. Use of cranes and other high-profile equipment would require a "spotter" when operating near any overhead hazards. To minimize vehicle accidents, construction personnel would direct heavy vehicles entering and exiting the site.

No Action

No impacts to health and safety would occur under the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts under this alternative would be similar to those under the Proposed Action. Construction workers conducting the infrastructure upgrades and HPW facility construction would be responsible for complying with standard operating procedures and applicable health and safety regulations; therefore, no impacts would be expected to occur. Digging clearances would be obtained from Base Civil Engineering and Base Utilities prior to excavating soil and installing utilities associated with the infrastructure upgrades. The IRP sites (that is, EFDZ 4, 7, and 8) located within roadways that may be resurfaced or replaced have no digging restrictions associated with them; however, soil disturbing activities must be approved by Base Civil Engineering and Environmental Management Division personnel.

Impacts to health and safety of nearby personnel would be minimized by clearly identifying the construction zone and prohibiting access to unauthorized individuals. Use of cranes and other high-profile equipment would require a "spotter" when operating near any overhead hazards. To minimize vehicle accidents, construction personnel would direct heavy vehicles entering and exiting the site.

4.11 Socioeconomics

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The estimated total construction cost for the infrastructure improvements and HPW facility construction project is approximately $257 million, including construction-related employment, materials, and supplies. These construction costs would equal about 17 percent of WPAFB's annual expenditures for goods and services and would have a beneficial, although temporary, effect on the local and regional economy. It is likely that much of the material and work force for the projects would be from local sources, or sources within Ohio or adjacent states. Businesses near WPAFB, such as lodging, gas stations, and restaurants, also would benefit from additional sales to construction workers.

There would be both short-term and long-term beneficial impacts on the local and regional economy from the infrastructure upgrades and the construction and operation of the HPW complex. The Proposed Action would result in a temporary, minor increase in employment and regional spending during infrastructure upgrade and the HPW complex construction activities. Beneficial long-term economic development would result from the additional personnel and their families relocating to the area. The HPW complex is expected to employ 1,200 staff. While some of these positions may be filled by persons who already reside in the area, many will be specialists who will relocate with the missions to the southwest Ohio area. The Dayton Development Coalition has estimated that the HPW relocation to WPAFB could have as much as a $100 million positive impact on the local economy (*Dayton Daily News*, January 28, 2007).

Housing is available in the four-county area surrounding WPAFB. The incoming personnel to the region would negligibly affect housing demand.

No Action

This alternative would require no construction and therefore would generate no construction-related employment. This alternative would cause no change in employment at WPAFB.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The construction of the infrastructure and HPW complex in phases may lengthen the construction period somewhat and may increase the expense of construction. This approach, however, would not substantially change the overall impact of the project on the local and regional economy compared to the Proposed Action.

4.12 Transportation/Traffic

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The relocation of the BRAC missions to the Hilltop District will comprise an influx of approximately 1,200 staff, approximately 150 pipeline students, and various transient students and visitors. Based on the number of additional employees, an estimate was made of the future traffic levels at Area B on local roadways in the project area and at the gates (KZF/BWSC, 2007b). The expected additional traffic represents a 21 percent increase in inbound traffic to Area B. The impact of this additional traffic will be especially noticeable during the morning peak hour, the most crowded daily traffic period (Table 9).

TABLE 9
Expected Increase in Traffic Volumes to Area B from the BRAC 2005 Missions

Gate	Existing Conditions		Projected Increase in Traffic with the Proposed BRAC Facilities	Projected Traffic at Gates with Proposed Improvements	
	Capacity	Volume	Volume	Volume	Capacity
1B	800-1,200	900	+ 200	1,100	800-1,200
19B	800-1,200	1,000	+ 300	**1,400**	**1,200-1,800**
22B	1,600-2,400	1,800	+ 500	2,200	1,600-2,400
Total	**4,800**	**3,700**	**+ 1,000**	**4,700**	**5,400**

An analysis of traffic was performed using a distribution of vehicles at the gates equal to the current distribution. While Gates 22B and 1B appear to have capacity for the additional traffic, operations at Gate 19B would be degraded for several reasons. The existing Gate 19B can process traffic under Force Protection Condition (FPCON) Alpha at a rate of 400 to 600 vehicles per hour per lane; there are two inbound lanes at this gate, meaning that 800 to 1,200 vehicles can be handled at that gate

under current conditions. The estimated 1,000 additional vehicles using Gate 19B with the completion of the BRAC facilities will clearly exceed the capacity of this gate, causing traffic problems along National Road.

The Proposed Action would relocate Gate 19B along National Road to the intersection with Reese Drive (Figure 3). The relocated gate would provide greater vehicle queuing capacity by having two entry lanes, widening to three checkpoint lanes, and by placing the security checkpoint farther from National Road. National Road would be widened to the west (on WPAFB land) to allow for an additional southbound right turn lane and a northbound left turn lane at the new/relocated gate. These additional lanes also will increase storage capacity for inbound vehicles and allow for uninterrupted through traffic along National Road. The existing southbound left turn lane onto Reese Drive would be maintained.

The relocation of the gate also will provide benefits to circulation within Area B. The realignment would place the main access road to Gate 19B between the HPW and the Air Force Institute of Technology (AFIT) complexes, better dividing traffic between the major destinations of the Sensors Directorate and AFIT (south on Hobson), HPW (north on Hobson), and rest of base (west on 8th Street). This alignment would give a more balanced distribution and lessen the need for overall widening of on-base roads. It also minimizes through traffic in the AFIT and HPW complexes, which will improve the cohesiveness of both complexes and their compatibility for pedestrians.

The Proposed Action also includes improvements to roadways in the Hilltop District to accommodate the additional local traffic. The proposed improvements would streamline traffic flow within Area B by redistributing traffic to particular major thoroughfares, namely Hobson Way, 8th Street, and 10th Street. Hobson Way would be widened between 5th and 13th streets, increasing the capacity of this street and further improving connectivity of the Hilltop District to the primary arterials. 8th and 10th streets would be widened to three lanes in the Hilltop District to improve east-west connection to the primary arterials. Dedicated turn lanes would be provided at the Hobson Way intersections with 8th and 5th streets.

LOS was calculated using traffic models for the current conditions and for the improved conditions. Traffic analysis for the Hilltop District in the built condition, and assuming the future traffic volumes of the BRAC facilities, shows that these proposed improvements will provide a minimum LOS "D" for each intersection in the Hilltop District (Table 10) (KZF/BWSC, 2007b) (Appendix G).

TABLE 10
Local Roadway Levels of Service in the Hilltop District Project Area with the HPW Facilities and Other Future Construction Projects

	Level of Service (LOS) With Proposed Improvements		**Level of Service (LOS) With Existing Roadway Geometry**	
Intersection	Morning Peak Hour	Evening Peak Hour	Morning Peak Hour	Evening Peak Hour
Hobson Way at 5th Street	D	D	F	F
Hobson Way at 8th Street	C	C	F	F
Hobson Way at 10th Street	D	D	F	F
Hobson Way at 13th Street	B	B	F	F
Skyline Drive at 8th Street	D	D	C	C
Skyline Drive at 10th Street	D	D	C	C
National Road at Reese Drive/Relocated Gate 19B	B	D	E[a]	E[a]

[a] The existing roadway geometry in this case assumes the new gate is opened as proposed, while the existing National Road geometry remains the same.

Analysis of traffic expected at the relocated Gate 19B/Reese Drive intersection found that the proposed additional turn lanes along National Road will provide adequate capacity and an acceptable LOS at this intersection. Excluding these additional turn lanes with the opening of the new gate would degrade traffic operation at this intersection.

Other roadway improvements largely include repaving or reconstruction of existing roadways in the Hilltop District, including sections of 1st Street, 9th Street, 5th Street, 10th Street, 13th Street, Skyline Drive, and Q Street. None of these actions would reduce parking.

Various options would improve pedestrian access with the provision of new or improved sidewalks along streets in the more densely developed areas (9th Street, 10th Street, and Hobson Way). Options to improve these streets without sidewalks may create a pedestrian safety hazard.

No long-term impact to the traveling public outside the base is expected from the proposed improvements. Based on the current patterns, most traffic enters at the gate nearest their destination in Area B. While improvement in the circulation within Area B might help to balance the traffic between gates, the current pattern is not expected to be substantially changed, as backups occur at all gates during the morning peak hour.

Over the short term, the addition of construction traffic to the normal traffic volumes entering during the morning hours will likely have a short-term negative impact on the traffic backups along National Road at Gate 19B (nearest the construction site). There also will be short-term disruptions of traffic flow within the Hilltop District during construction. While inconvenient, access will be maintained to all active facilities throughout construction.

During construction, traffic would be maintained along National Road and to facilities in the Hilltop Area. The new Gate 19B would be constructed first. Thereafter, the relocated gate would provide both normal traffic and construction traffic access for the remainder of the infrastructure construction. If necessary during the switch, Gate 16B temporarily may be opened. During the HPW complex construction, temporary security fencing would be installed around the construction site, which would block off 5th Street from Q Street to Hobson Way, Hobson Way from 5th Street to 7th Street, and 1st Street west of Q Street. Construction traffic and normal traffic would continue to use the new Gate 19B until the fencing is complete. At that time, a dedicated construction traffic gate would be opened on Kauffman Avenue into the construction site. The section of Q Street north of 8th Street would be cutoff by the construction site fencing. To maintain normal access to this section of Q Street, a temporary roadway would be installed around the perimeter of the construction site from Hobson Way to Q Street.

No Action

The No Action Alternative would have no impact on the roadway network in the project area. For the immediate future, no change in traffic circulation would be expected; however, because new missions and facilities will be located in the Hilltop District, it is foreseeable that traffic issues will

occur. Longer backups of greater duration will likely occur at Gate 19B with the additional traffic; these backups may affect through traffic along National Road. Traffic movement within the Hilltop District also will be degraded with additional traffic (Table 10). Issues of pedestrian safety are likely as traffic increases without the provision of sidewalks along busier streets. The existing pavement of many roads that are in poor condition will continue to decline.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Over the long term, this alternative would have the same effect on traffic as the Proposed Action because the final product would be the same. There also may be little difference between alternatives over the short term. Under any alternative, the roadway improvements will likely be constructed in phases in order to maintain traffic to existing facilities, and to accommodate the construction of proposed utility lines that will cross or run parallel to the roadways. An approach that encompasses all roadway improvements together, as in the Proposed Action, may provide greater opportunities for more efficient construction and a shorter construction period than an approach that would define the segments and timing of roadway construction by the construction limits and schedule of adjacent new facilities.

4.13 Utilities

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The Proposed Action will have a beneficial effect on utilities in the Hilltop District by updating and upgrading existing utility systems, along with construction of the new HPW complex. Some short-term interruptions to service could occur at the existing facilities while new lines are tied in—it is anticipated that these interruptions could be performed to minimize any loss of service during critical times. In each area of excavation, existing utilities will be marked in advance to avoid accidental disturbance of existing service.

Upgrading or extending the electrical, gas, or water lines alone would have little or no impact on the supplies in the area; however, the intent of the proposed improvements is to provide for the construction of new facilities, which would draw upon these resources. The impacts of these upgraded utilities and the new facilities are summarized below.

4.13.1 Steam

The aboveground steam lines would be replaced with below ground lines that have sufficient capacity to carry the peak steam loads to the facilities.

Calculations for the required steam are based on the floor area of each of the proposed facilities. The combined additional steam requirement of the proposed BRAC facilities, plus the AFIT and ITC facilities that are proposed under separate projects in the Hilltop District, would be approximately 72,000 lb/hr under a peak load. Calculated steam load for the HPW complex is 60,000 pounds of steam per hour. With the new facilities, the combined peak demand would reach 292,000 lb/hr, meaning the third boiler would need to be fired more frequently than it is with the existing facilities, but would be able to meet the peak demand.

Extremely cold days may require additional steam. The higher demand can be accommodated by the additional gas-fired boilers, each with a capacity of 80,000 lb/hr.

4.13.2 Water and Wastewater

The preliminary estimate of the total additional water requirements for the HPW project is approximately 1 mgd. Expected wastewater flow is estimated to be 0.6 mgd. Water requirements are based on an assumed average water usage of 143 gallons per capita per day (gpcd), multiplied by the number of personnel expected in each facility. This average is based on 1.59 mgd recorded average usage in Area B during 2004 by a population of 10,000 people (excluding usage by Woods Housing). Wastewater flow is based on the wastewater generated by similar facilities as the HPW complex. The total water usage at Area B includes other industrial water uses such as heating and cooling water, process water, test water, etc.; therefore, this assumption accounts for additional usage that may come from laboratories and other industrial water uses at the new facilities.

In total, the requirements for water and wastewater treatment for the proposed facilities will be within the capacity of the existing wells and treatment facilities. The existing on-base water supply wells and treatment system have more than sufficient capacity for additional flows expected. This

system has sufficient capacity for the additional flow downstream of the proposed improvements. The analysis of the water supply system found that some of the proposed facilities will need individual fire pumps to increase flow during a fire event. These pumps would be part of each facility.

Wastewater from Area B is treated by the City of Dayton WWTP, which has more than sufficient capacity for the additional flow expected. An analysis of the wastewater collection system in Area B in 2006 divided the existing and near future loads (including the planned ITC, AFIT, and HPW facilities) among the "M" and "L" lines based on their available capacities (KZF/BWSC, 2007b). The analysis found that the system has the capacity for all of the existing and near future loads; however, several lengths of pipe were found that would reach or exceed capacity with the future loads. These pipe lengths have been identified for replacement with larger diameter pipes as part of this infrastructure project.

Two existing wastewater lines in the Downtown District area are proposed for replacement. One of these replacements will occur in the 10-year recharge zone of the City of Dayton's Mad River well field. The replacement of this line will occur in shallow excavation and the area would be restored, with no effects to the quality of the aquifer. Over the long term, this replacement will have a positive impact by protecting the aquifer from potential contamination from the wastewater line.

Public water and wastewater systems are regulated under the federal CWA. In Ohio, the authority to regulate these systems has been delegated to the Ohio EPA. Ohio EPA requires a PTI for replacement of existing water and wastewater lines, or additions to these systems. The Ohio EPA Division of Drinking and Groundwater reviews and approves plans for the expansion of public drinking water supplies pursuant to OAC 3745-91-02. The Ohio EPA Division of Surface Water reviews and approves improvements to wastewater systems pursuant to OAC 3745-42-02. These reviews ensure the safety of the water supply, minimal risk of groundwater contamination, and capacity of the wastewater collection and treatment system. As the final design is selected and developed, WPAFB would coordinate the design with Ohio EPA to obtain the required approvals.

Prior to the possible construction of the additional wastewater lines, the design drawings along with a cover letter would be submitted by WPAFB to the City of Dayton WWTP. The Dayton WWTP would evaluate the design relative to the capacity of the WWTP and provide a concurrence letter. The design/construction contractor would then prepare the PTI application, including the design drawings, specifications, and WWTP concurrence letter. The base would submit the application package to Ohio EPA.

4.13.3 Natural Gas

Natural gas may be used for heating and various other minor services. The natural gas requirements for the proposed facilities currently are unknown. Most heat is expected to be provided by the steam system, reducing the requirement for natural gas at each facility. The local gas supplier, Vectren, has indicated that any additional natural gas needs can be met from the existing mains and supplies.

4.13.4 Electrical

Service to the majority of the new Area B facilities would be from Substation A. Following the new ITC and AFIT expansion, this substation will have 24 MVA available. In the worst case, the new BRAC load is expected to be 11 MVA, which is still within the capacity of the transformers; however, new 12-kV circuits may be required to serve the new load. This upgrade can be accomplished at the substation without a substantial redesign.

One independent service line would be supplied from Substation F to supply energy for special centrifuge loads. This circuit will allow for the additional energy needed during equipment startup. It also would loop to Substation A.

Service to some of the new buildings would be from Substation F. The available capacity of this substation is 14 MVA, which is considerably greater than the expected additional load of 5.7 MVA. Existing circuits at the substation have the capacity to serve this load.

4.13.5 Communications

All new ducts that are installed or existing lines that are relocated would be placed underground. Main lines would continue to parallel existing roadways, and new lines would be run underground to facility locations. An additional communications information transfer node (cable hut) would be installed at one of the future BRAC facilities.

While minor scheduled outages of some communications may be necessary for making new connections, no interruption of the existing network is expected.

No Action

The No Action Alternative also would have no impact on the existing water, electric, or natural gas supply, nor add load to the City of Dayton WWTP system.

This alternative also would forego construction of the proposed HPW facilities. Many of the improvements, such as steam line relocation, are necessary for siting one or more of the facilities. The utility capacity also would not be available for the operation of the facilities.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

The phased approach to upgrading and revising the utility lines would have comparable long-term impact on utility service and supplies as the Proposed Action. Depending on how the construction is implemented, successive upgrades and tie-in of each facility as it is built may cause more frequent temporary outages of utility service to the existing facilities than if large sections are constructed concurrently.

4.14 Environmental Justice

Construct BRAC Infrastructure Upgrades and HPW Complex (Proposed Action)

The majority of ground disturbance associated with the infrastructure upgrades and HPW complex construction would occur within the boundaries of WPAFB. Some activities associated with relocation of the base entrance would occur outside the base boundaries, such as widening of lanes on National Road and intersection improvements at Reese Drive and National Road. As discussed in

Section 4.11, there would be both short-term and long-term beneficial impacts on the local and regional economy from the infrastructure upgrades and the construction and operation of the HPW complex. There is little potential for the Proposed Action to have a disproportionately high adverse human health or environmental effect on low-income and minority populations that are located outside the boundaries of WPAFB**.**

No Action

There would be no environmental justice issues with the No Action Alternative.

Infrastructure Upgrades to be Completed as each BRAC Facility is Constructed

Impacts under this alternative would be similar to those under the Proposed Action. The majority of ground disturbance associated with the infrastructure upgrades and HPW complex construction would occur within the boundaries of WPAFB. Some activities associated with relocation of the base entrance would occur outside the base boundaries, such as widening of lanes on National Road and intersection improvements at Reese Drive and National Road. As discussed in Section 4.11, there would be both short-term and long-term beneficial impacts on the local and regional economy from the infrastructure upgrades and the construction and operation of the HPW complex. There is little potential for the Proposed Action to have a disproportionately high adverse human health or environmental effect on low-income and minority populations that are located outside the boundaries of WPAFB**.**

4.15 Cumulative Impacts

Cumulative effects are those that may result from the incremental impact of the federal action (construction of infrastructure upgrades and the HPW complex) when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such actions (40 CFR § 1508.7).

Projects planned in Area B during FY 2007 and FY 2008 include the demolition of Facility 20464 (gas station), renovation of Facility 20023 (Advanced Power Research Laboratory), and the partial demolition of Facility 20450 (WPAFB, 2006b). In addition, infrastructure upgrades for the ITC (FY

2009 and FY 2010) and the Materials Computation Research Facility (FY 2010), and additions to the AFIT would be taking place. Other BRAC facility construction, namely the Sensors Directorate expansion, also is expected to occur in the near future. (Construction of Sensors Directorate complex will be addressed in a subsequent NEPA analysis.)

Collectively, these projects would comprise approximately 130 acres of land in the Hilltop District. Approximately two-thirds of that area is currently open space (95 percent of which is maintained grass areas) and the rest is developed, such as existing roadways, building sites, or parking lots. Upon completion of construction, approximately 25 percent of the development area would be returned to maintained open grass area (surrounding buildings and parking lots). Thus, there will be a cumulative loss of open space in the Hilltop District as a consequence of these developments.

The construction of all of these projects will require soil disturbance over most of the area, and potential for soil erosion, during construction activities. As required for the NPDES permits, site-specific Storm Water Pollution Prevention Plans would be developed for each project. The implementation of erosion control at each site during construction will control the loss of soil from the area.

The cumulative effects of construction of the BRAC HPW facilities on the utilities and traffic in the Area B Hilltop District have been addressed elsewhere in this EA. Analyses of loads generated by the BRAC facilities on each utility, including water, wastewater, and natural gas, were performed assuming that the other projects, namely ITC and AFIT, were already existing facilities. Consequently, the proposed infrastructure upgrades would address the cumulative needs for increased utility support for all of these projects. Similarly, the proposed roadway improvements were designed in consideration of the vehicular and pedestrian traffic generated by all of the proposed facilities. The proposed improvements are expected to provide improved traffic flow throughout the Hilltop District, as well as improved connection with the rest of Area B. The improvements also will funnel through traffic to major roadways between complexes, thereby

improving pedestrian access between the parking areas and the facilities and the overall compatibility of each complex for pedestrians.

Expansive residential and commercial development, with associated roadway and other infrastructure upgrades, also has been occurring in the areas surrounding WPAFB, namely western Greene County and, to a somewhat lesser degree, eastern Montgomery County. While changes at WPAFB, the largest employer in the region, are considered in decisions regarding new land development and infrastructure improvements, these decisions also are made in consideration of other regional socioeconomic indicators. As much of the recent development was in planning or in progress prior to the 2005 BRAC decisions, and its success is dependent on a far greater population than is expected from the new missions, the cumulative impacts of this development cannot be attributed to BRAC or other mission changes at WPAFB.

These projects would have a substantial positive, cumulative impact on the local and regional economies. The BRAC missions (HPW and Sensors Directorate) would comprise the greatest permanent economic impact of the proposed projects in the Hilltop District. In addition to the DoD staff directly related to these missions (about 1,200 for HPW and 400 for Sensors Directorate), the Dayton Development Coalition (2005) estimates a total of 275 contractors supporting the missions, plus nearly 1,300 indirect positions (non-government, off-base "spin-off" jobs that provide services to workers in direct jobs) will be added to the region. The Coalition estimates the consequent impact to the local economy to be an additional $100 million (*Dayton Daily News*, 2007). It is clear from reports by the Dayton Development Coalition and local news media that the regional infrastructure and economy are poised to accommodate the influx of personnel associated with these missions.

The AFIT campus expansion and renovation also will accommodate additional staff and students. The actual impact of that expansion is uncertain, depending on enrollment, but is expected to be less than the BRAC missions. The ITC project is a consolidation of existing information technology operations already located at various facilities across the base, and therefore does not represent a permanent impact on the local economy.

4.16 Unavoidable Adverse Effects

If the Proposed Action (that is, construction of infrastructure upgrades and the HPW complex) were implemented, there would be a commitment of soil that is excavated as part of the utilities installation work. Impacts to vegetation would be minor because the species types are common to the base (that is, ordinary vegetation), and the areas excavated would be reseeded and landscaped. There would, however, be an unavoidable loss of wetlands in the area of the proposed relocated Gate 19B and associated roadways. This impact is considered unavoidable in light of the engineering analysis of a number of alternatives that could avoid the wetlands (see Section 2.4.1). Compensatory mitigation would be undertaken at a nearby wetland to mitigate these impacts.

Minor, temporary impacts from noise would slightly affect passersby and nearby workers. The increase in noise primarily would be due to construction and excavation equipment. Construction noise would only exist during working hours and would end at the completion of the operation. A nominal increase in noise may be noticed once the HPW complex is completed due to increased traffic.

Temporary, minor increases in traffic would occur during construction. Once the relocated gate is constructed and roadway improvements are implemented, traffic patterns should adjust so that the increased volume flows more smoothly.

4.17 Relationship of Short-Term Uses and Long-Term Productivity

The Proposed Action addresses both upgrading the Area B Hilltop District infrastructure to provide adequate site utilities, communications, and roadways that would support multiple mission activities relocating to the base and constructing the HPW complex, the largest portion of the inbound BRAC missions. The 2005 BRAC law directs the movement of these organizations to WPAFB by 2011. Relocation and combining of programs will make the military more efficient, increase operational readiness, and cut costs.

4.18 Irreversible and Irretrievable Commitments of Resources

CEQ regulations in 40 CFR 1502.16 require that an agency identify any irreversible or irretrievable commitments of resources that would be involved in the Proposed Action, should it be implemented. Capital, energy, materials, and labor would be required for the action. These resources are not retrievable.

The proposed developments would include the loss of a small area of wetlands and streams at the proposed relocated Gate 19B site, and loss of open stream habitat north of 5th Street. While these impacts would be offset by mitigation, they represent an irretrievable commitment of resources.

5.0 List of Preparers

The following individuals assisted in the preparation of or provided background information for this EA:

Name/Expertise	Role	Affiliation
Teresa Carleton/NEPA Procedures, Biology	Report Preparation	CH2M HILL
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Robert Hook/Utilities, Transportation, Cultural Resources	Report Preparation	CH2M HILL
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6.0 List of Persons Contacted

Several persons were contacted or consulted during the preparation of the EA. The persons contacted are listed below:

Name	Role	Affiliation
Raymond Baker	Cultural Resources Program Manager	88 ABW/CEVO
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Fred Tito	Traffic/Transportation	88 ABW/CECP
Mary Knapp	Threatened and Endangered Species	U.S. Fish and Wildlife Services
Gary Koenig	Program Manager	88 ABW/CECW
Ken Lammers	Threatened and Endangered Species	U.S. Fish and Wildlife Services
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Debbie Woischke	Natural Resources	Ohio Department of Natural Resources; Division of Natural Areas & Reserves; Columbus, OH
Louis Zavakos	Project Engineer	88 ABW/CECX

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Figures

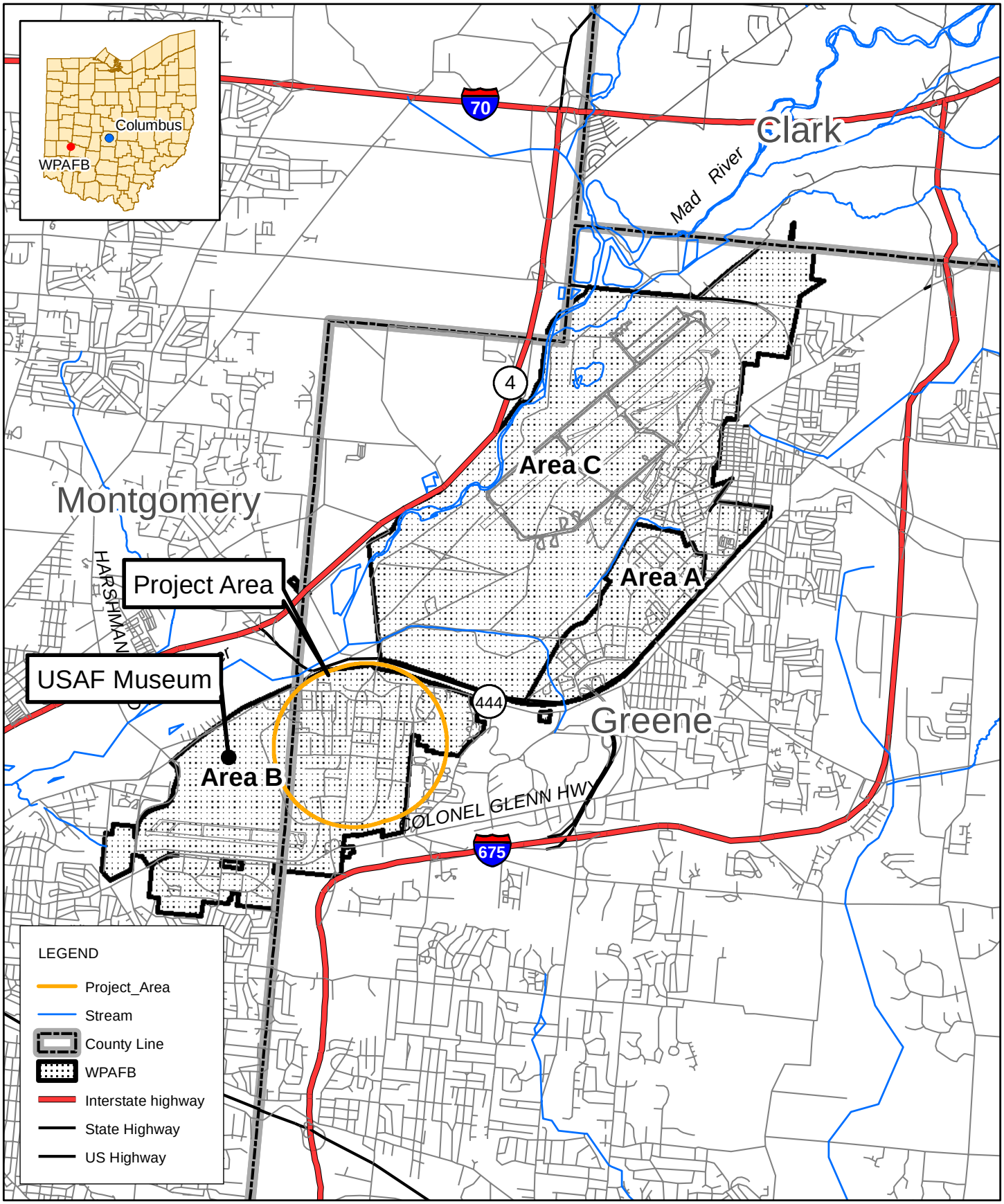

Figure 1
Location of Proposed Infrastructure Upgrades in the Area B Hilltop District
BRAC Infrastructure EA
Wright-Patterson AFB, OH

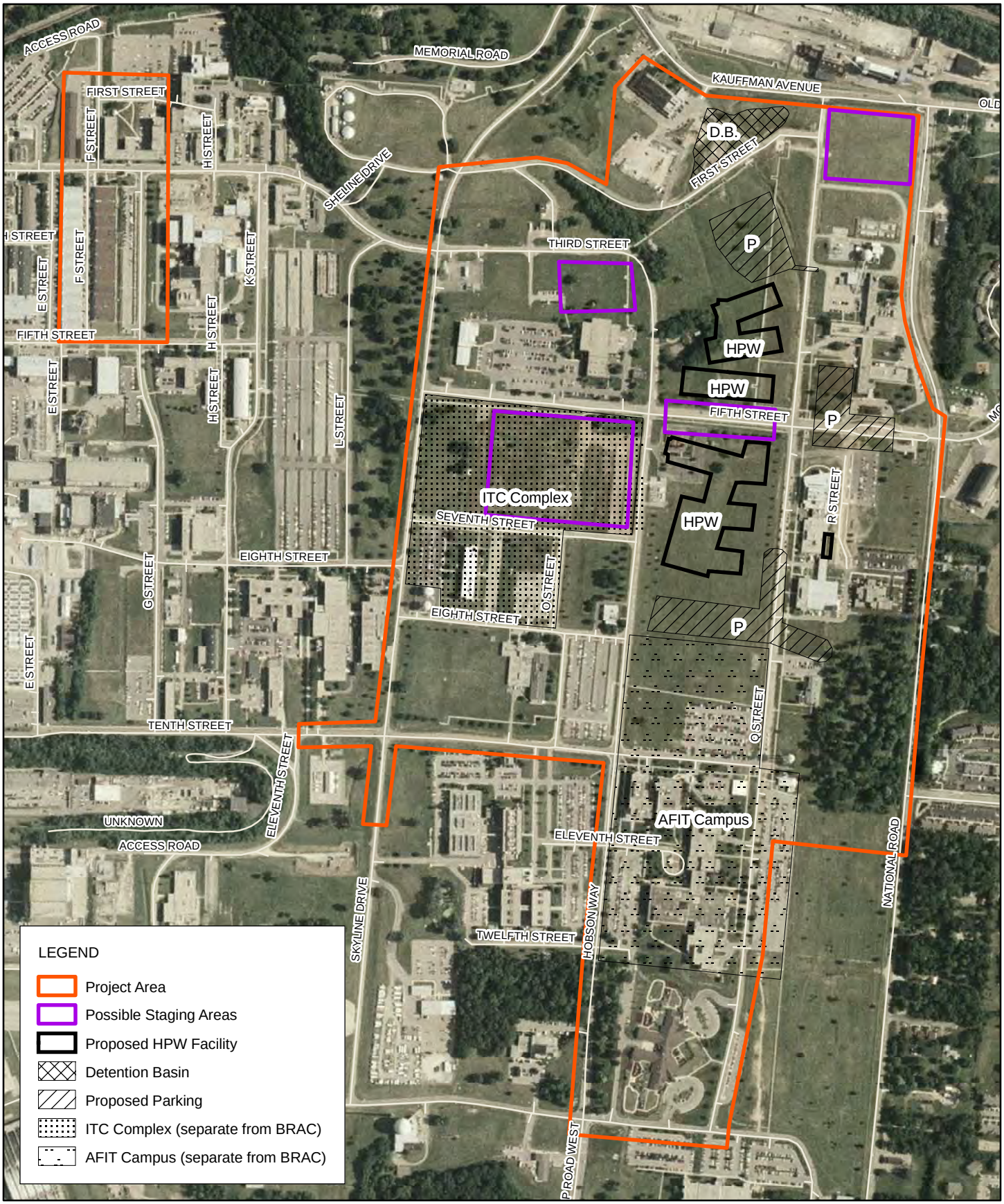

Figure 2
Location of the Proposed Project Area
BRAC Infrastructure EA
Wright-Patterson AFB, OH

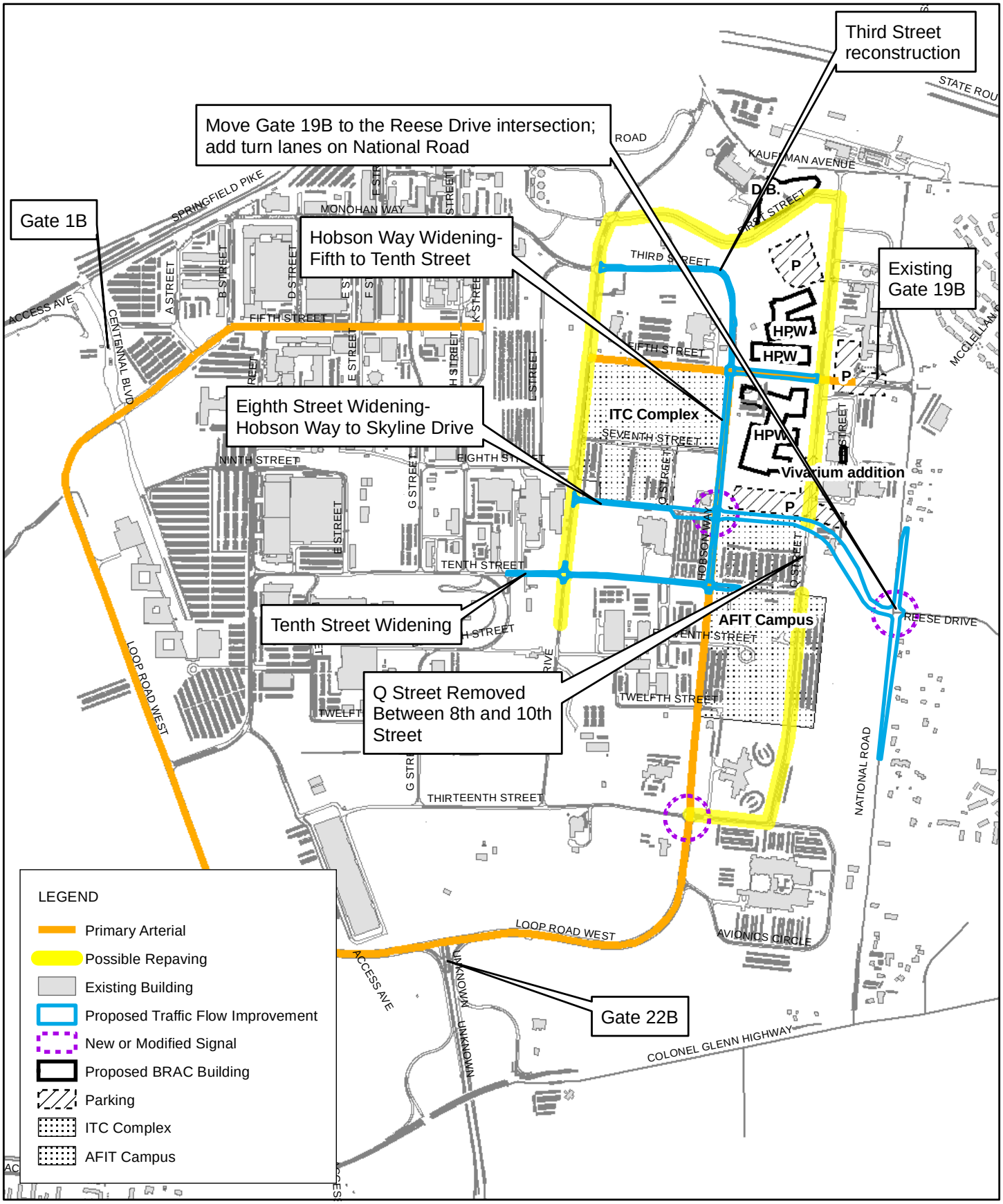

Figure 3
Proposed Traffic Flow Improvements
BRAC Infrastructure EA
Wright-Patterson AFB, OH

CH2MHILL

Figure 4
Demolition Locations, Facilities 20430 and 20682
BRAC Infrastructure EA
Wright-Patterson AFB, OH

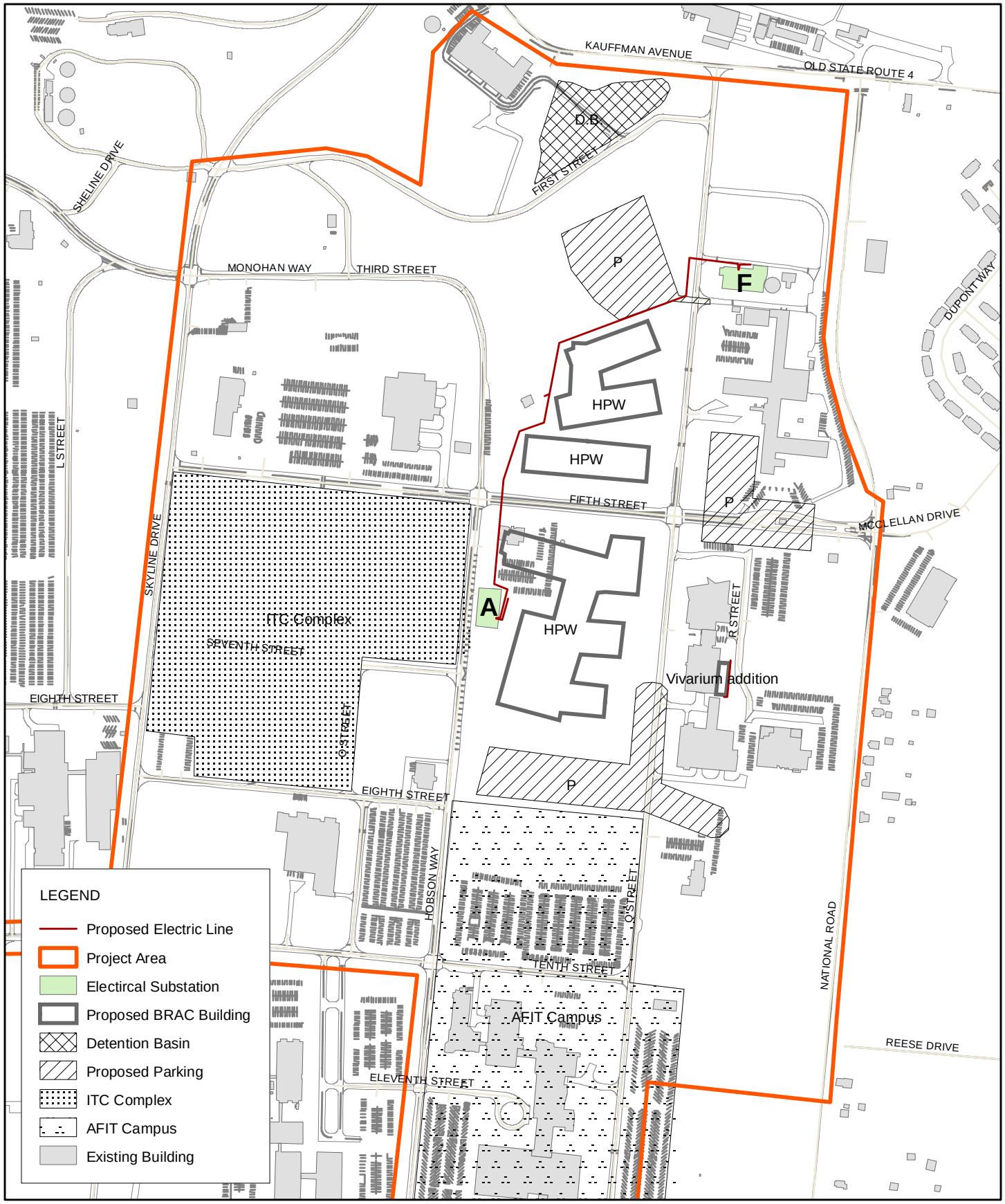

Figure 5
Proposed Electrical Line Upgrades
BRAC Infrastructure EA
Wright-Patterson AFB, OH

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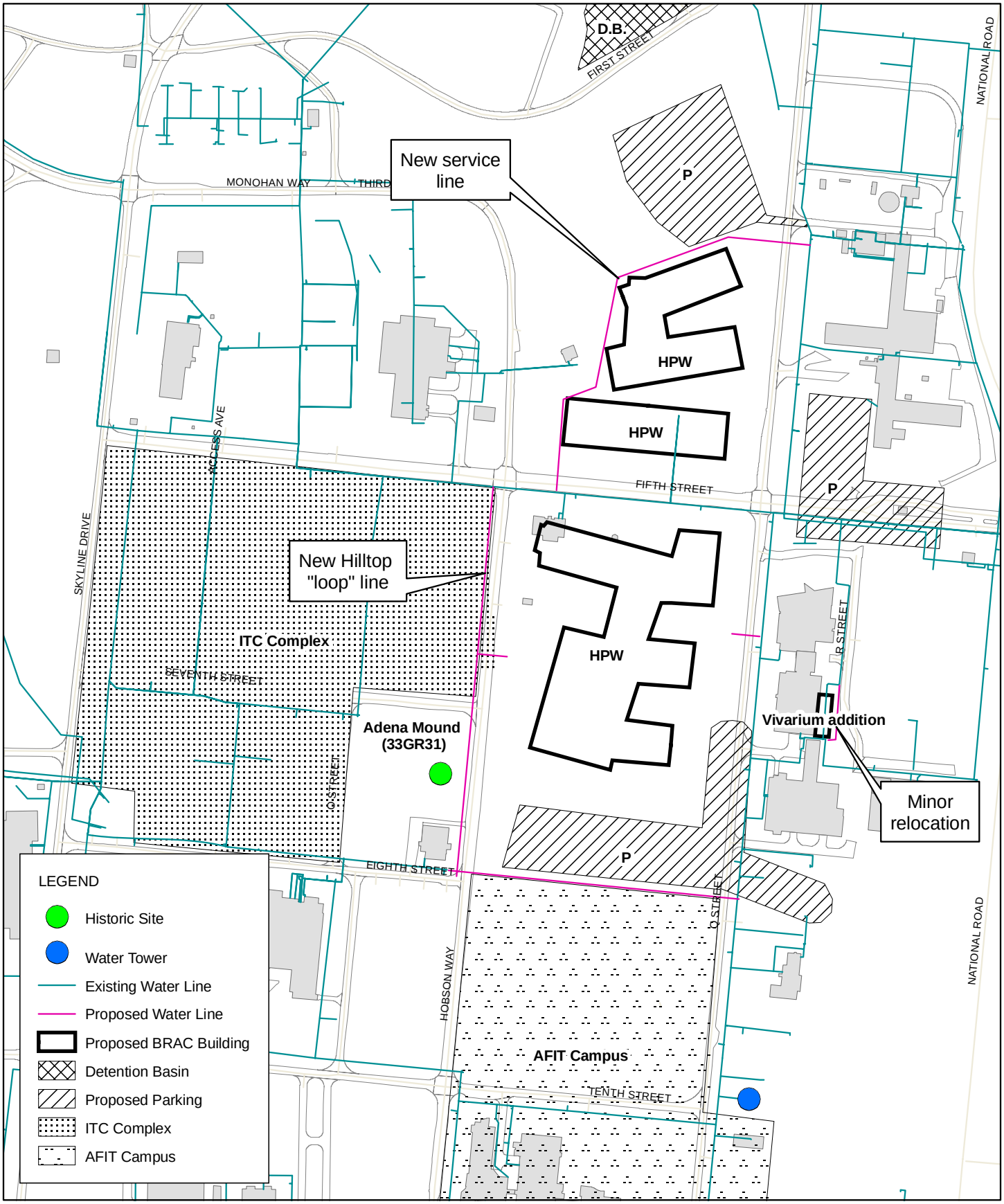

Figure 6
Proposed Water Distribution Upgrades
BRAC Infrastructure EA
Wright-Patterson AFB, OH

\\Antigone\proj\WPAFB\849318 - BRAC EAs\GIS\MapDocs\Figure 6 Water.mxd. September 14, 2007

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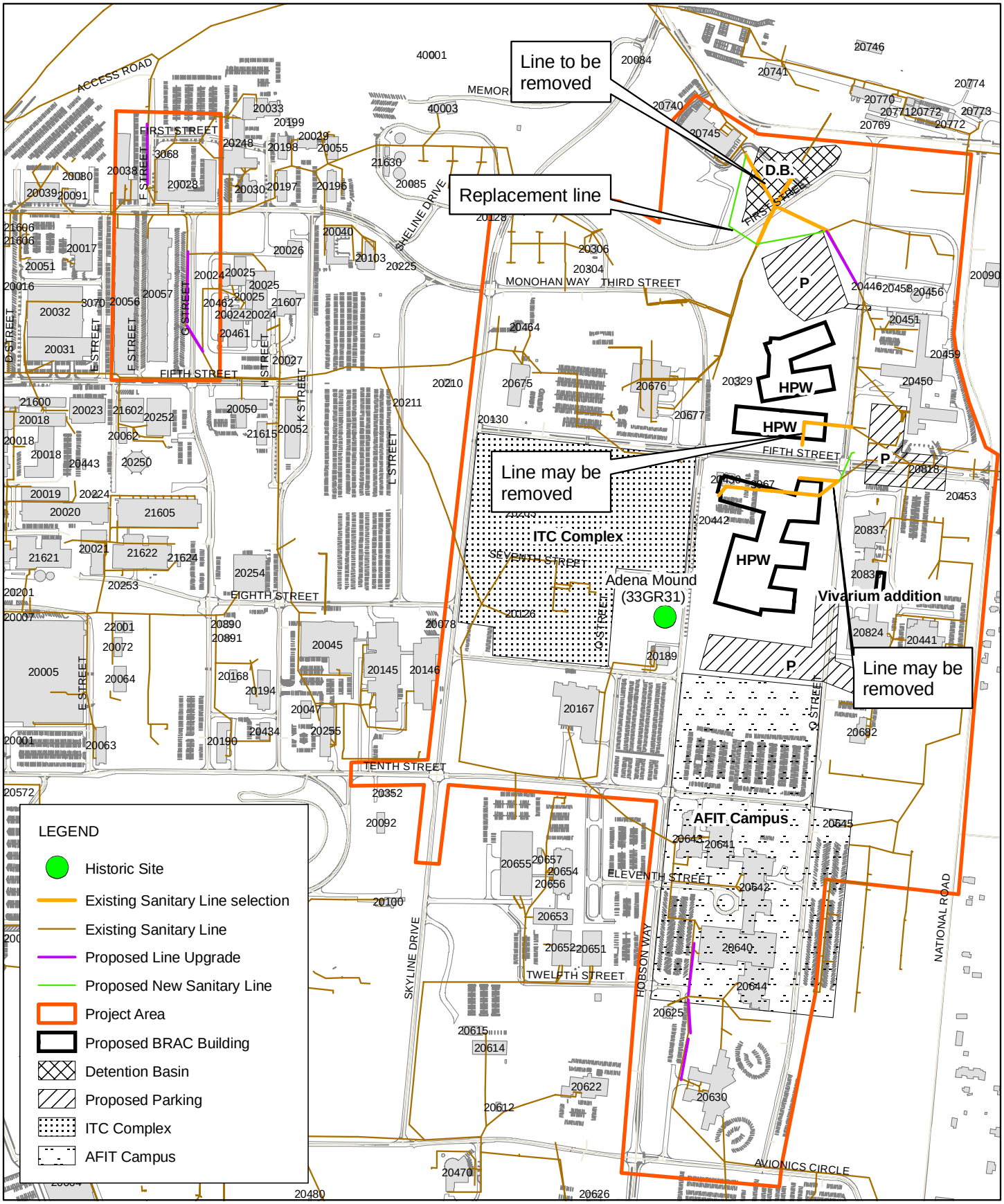

Figure 7
Proposed Wastewater System Upgrades
BRAC Infrastructure EA
Wright-Patterson AFB, OH

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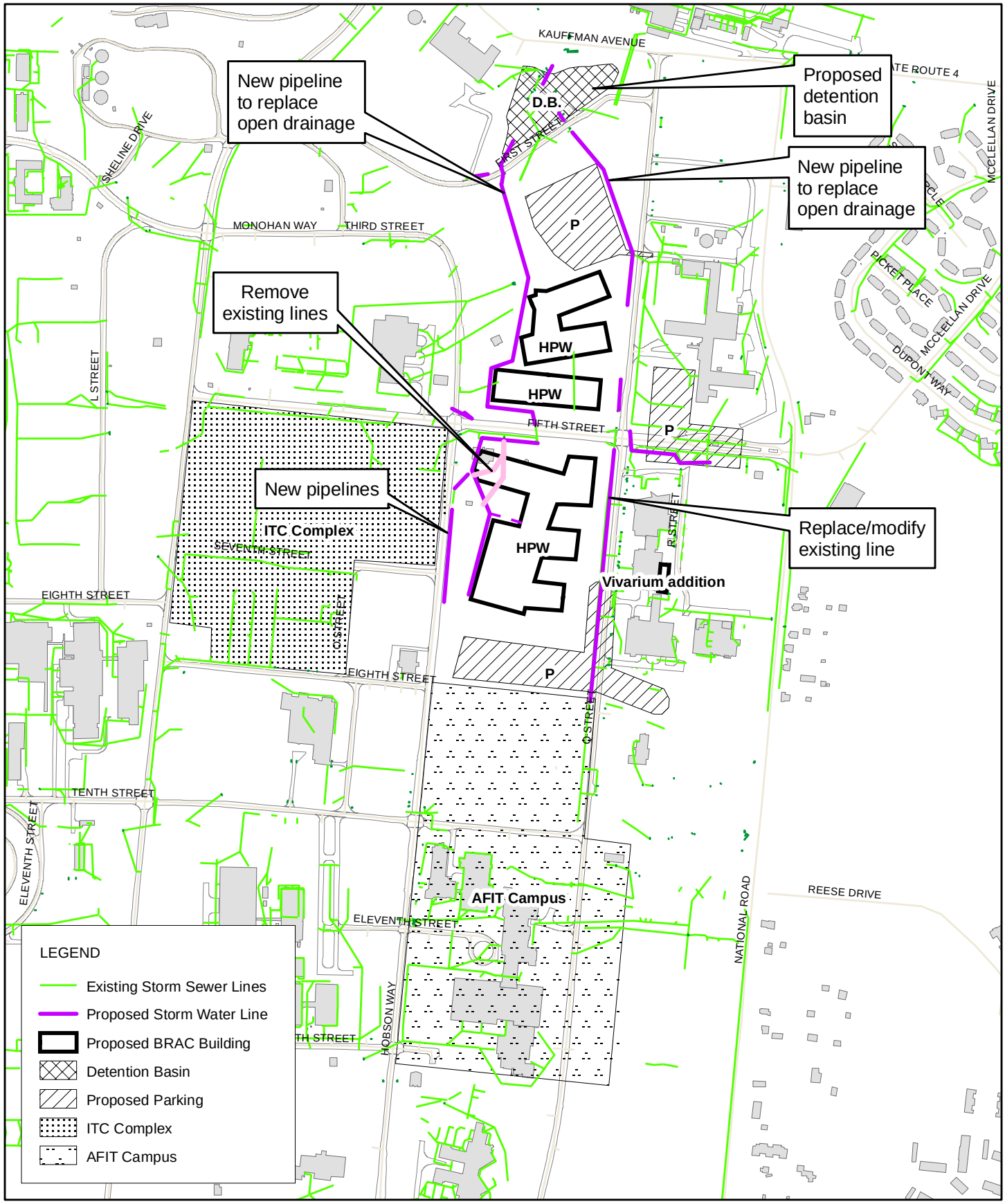

Figure 8
Proposed Storm Water System Upgrades
BRAC Infrastructure EA
Wright-Patterson AFB, OH

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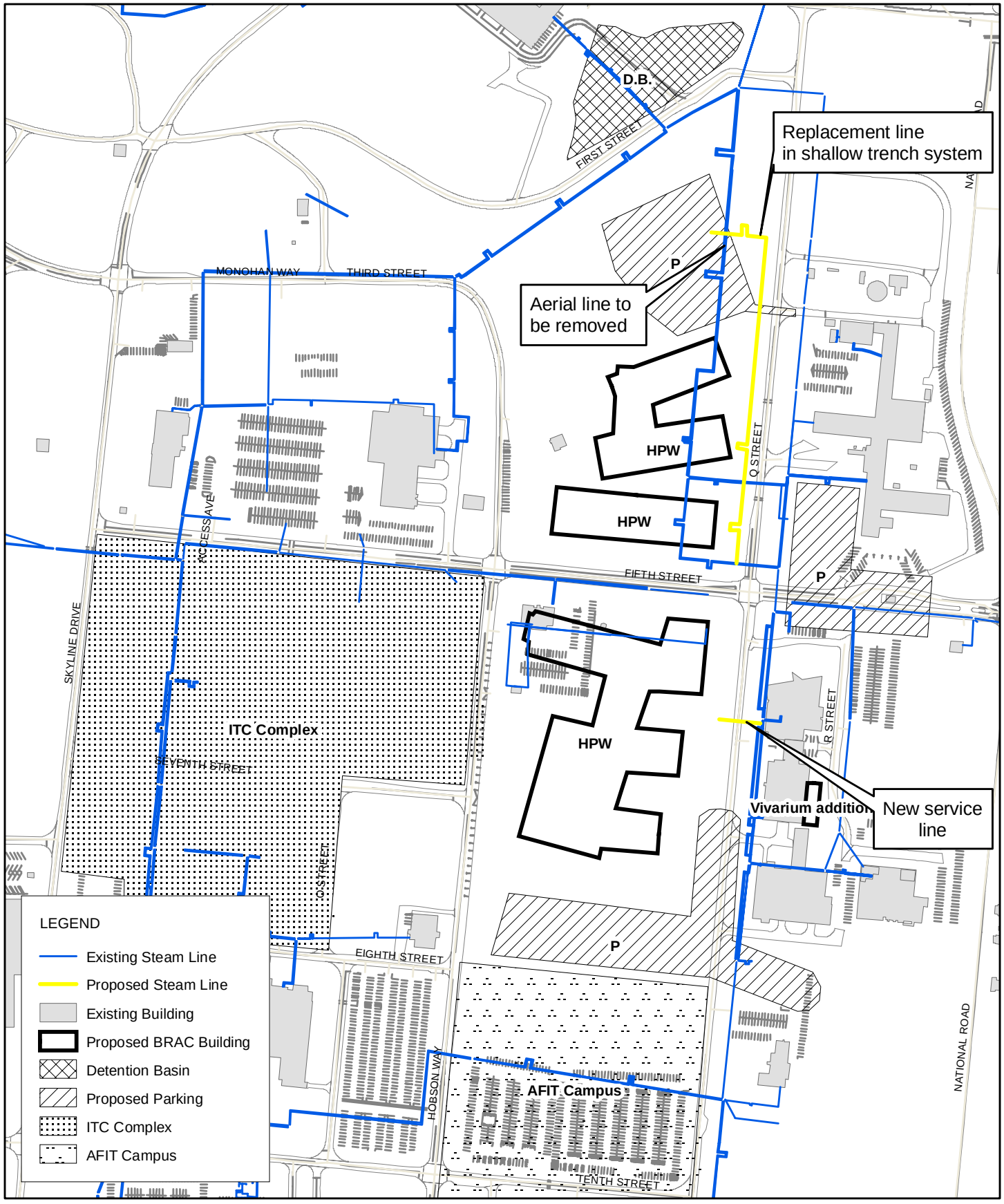

Figure 9
Proposed Steam Line Upgrades
BRAC Infrastructure EA
Wright-Patterson AFB, OH

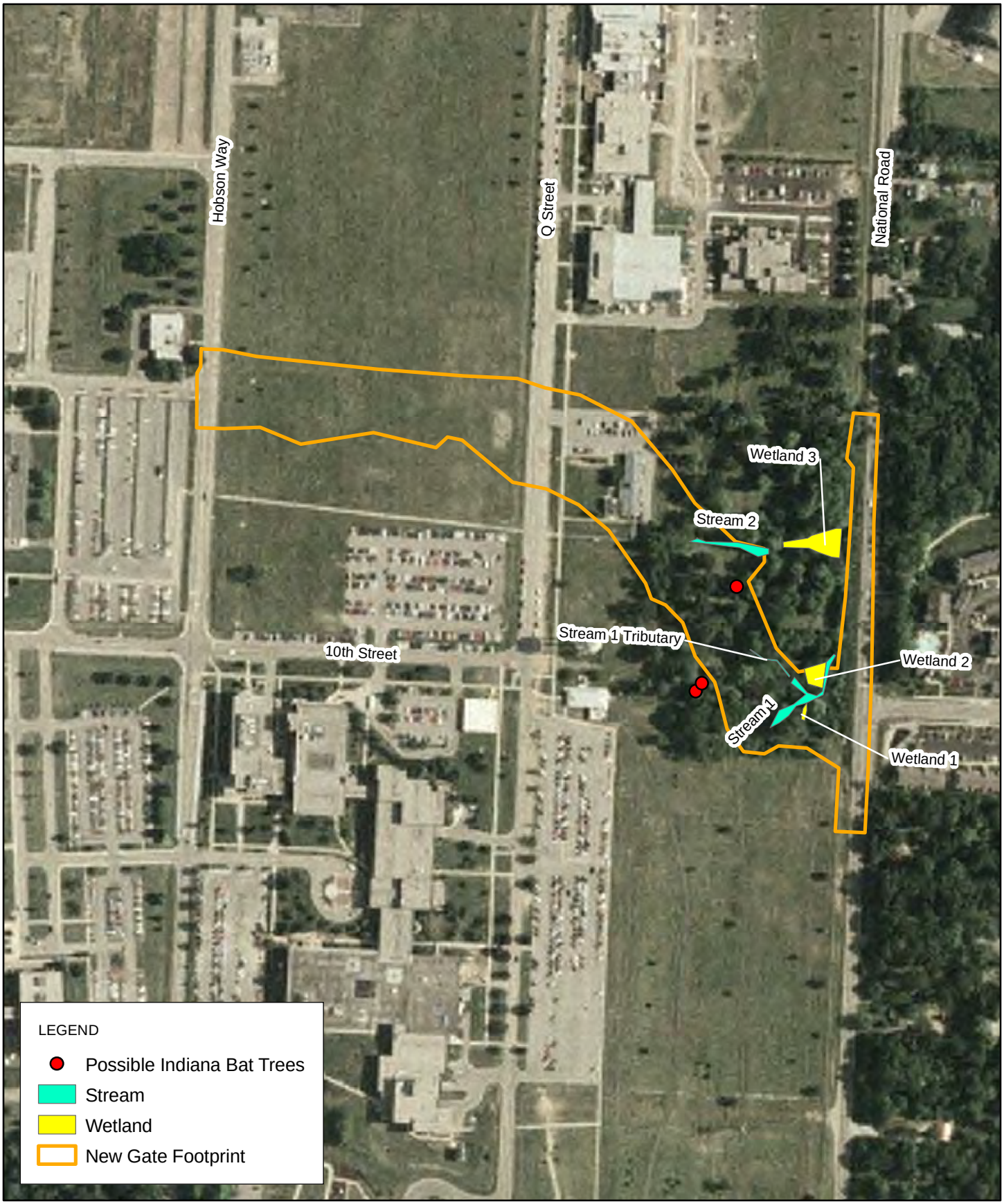

Figure 10
Wetland and Stream Locations Associated with the New National Road Gate
BRAC Infrastructure EA
Wright-Patterson AFB, OH

CH2MHILL

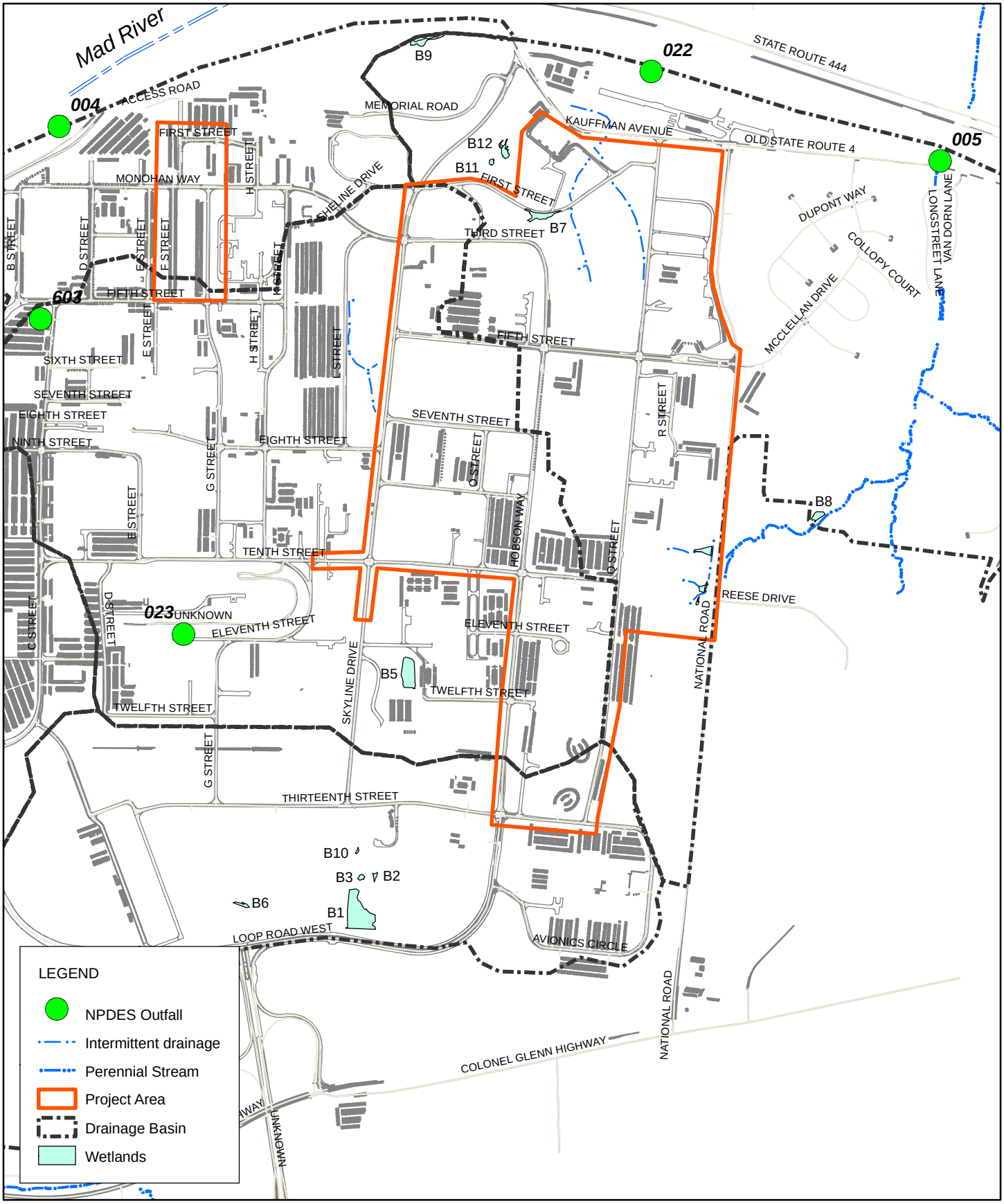

Figure 11
Storm Sewer Network Outfalls and Delineated Wetland Locations
BRAC Infrastructure EA
Wright-Patterson AFB, OH

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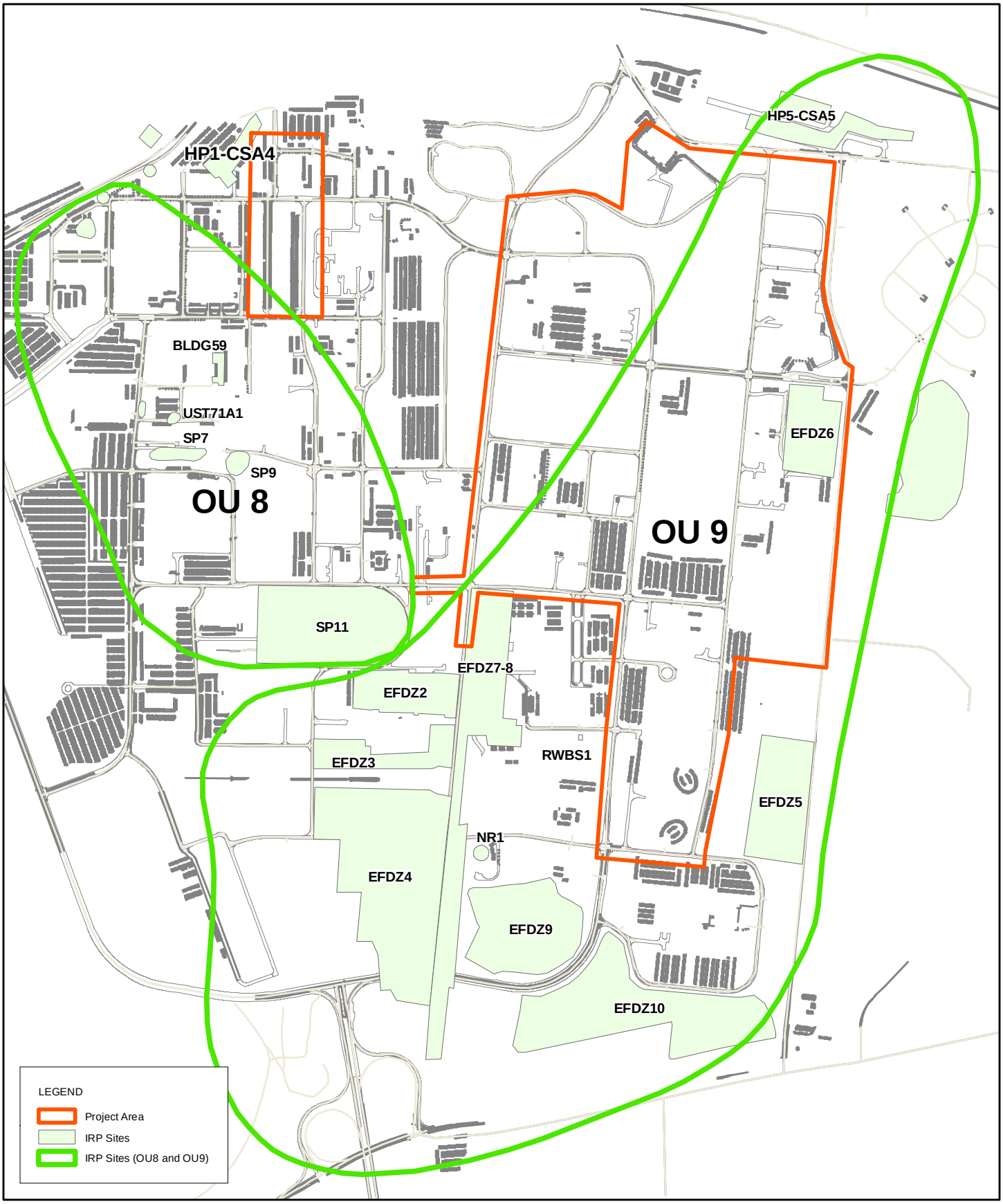

Figure 12
IRP Sites within the Area B Hilltop District
BRAC Infrastructure EA
Wright-Patterson AFB, OH

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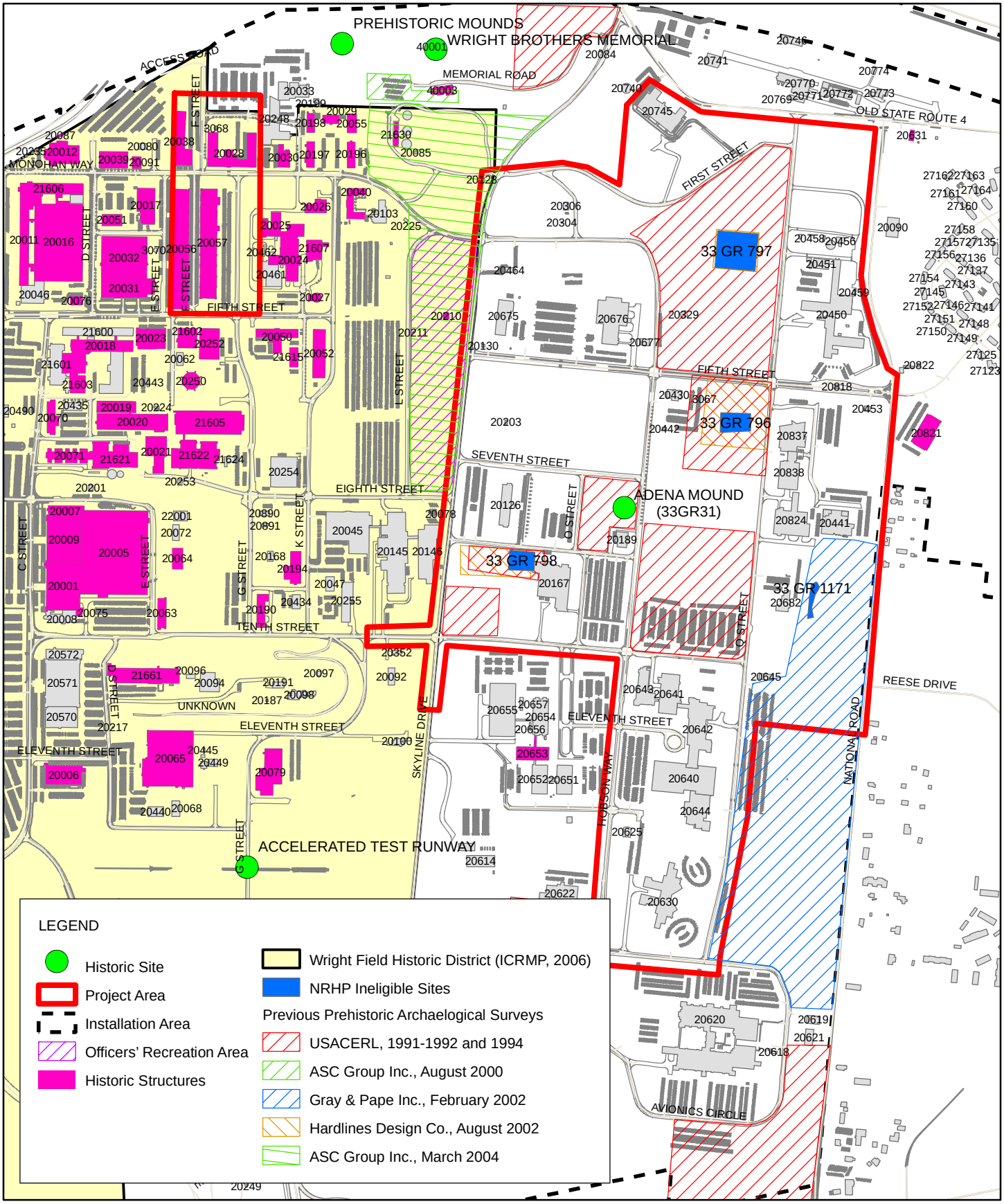
NOT FOR PUBLIC DISCLOSURE



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0 360 720
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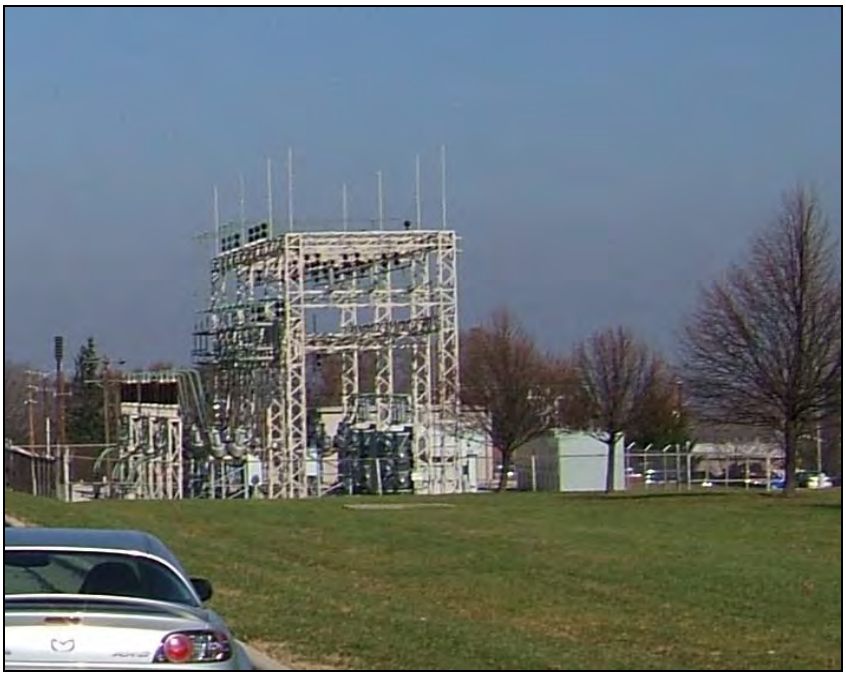
Figure 13
Cultural Recourses within the Area B Hilltop District
BRAC Infrastructure EA
Wright-Patterson AFB, OH

CH2MHILL

Appendix A
Site Photographs

Photograph #1: Proposed location of the AFRL/HPW Complex South (view to the west).

Photograph #2: Storm water drainage ditch in the vicinity of the proposed location of the AFRL/HPW Complex South (view to the south).



Photograph #3: Substation A in the area adjacent to the proposed location of the AFRL/HPW Complex North (view to the north).

Photograph #4: Proposed location of the AFRL/HPW Complex North (view to the east).

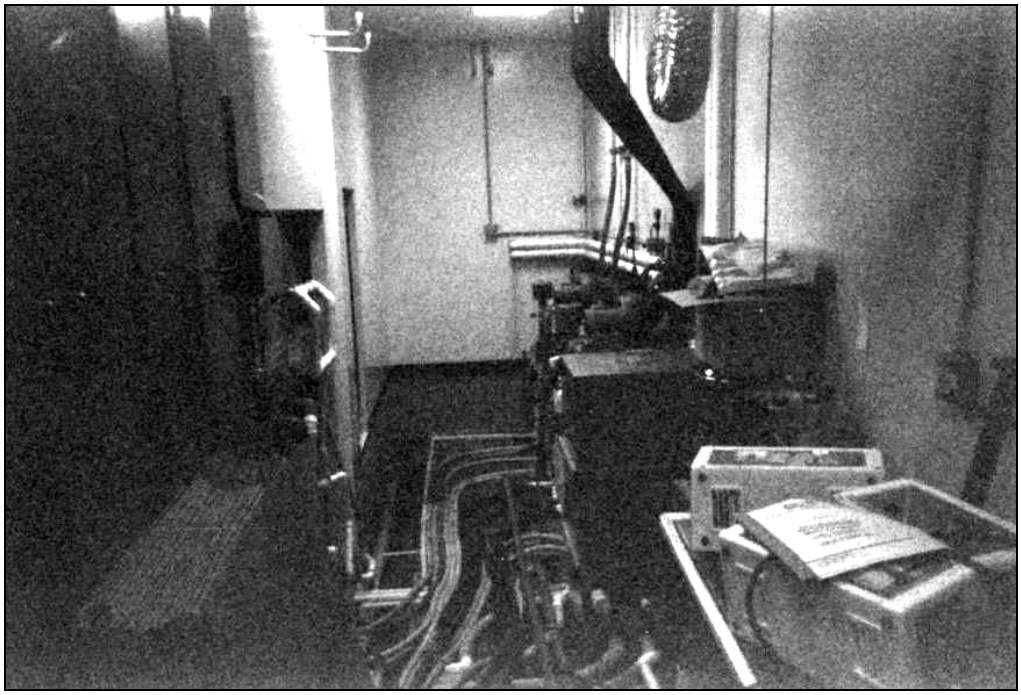
Photograph #5: Open drainage in the proposed location of the AFRL/HPW Complex North, just east of the Hunters Lodge (view to the north).

Photograph #6: Above ground steam lines in the proposed location of the AFRL/HPW Complex North (view to the northeast).

Photograph #7. Open drainage along the west side of Q Street, in the area of the proposed AFRL/HPW Complex North (view to the south).

Photograph #8: Building 20430, proposed for demolition.

Photograph #9: Building 20682, proposed for demolition.



Photograph # 10: Building 20682, process lines associated with black and white film processing.

Photograph #11: View along 1st Street, looking southwest; proposed location of detention basin.

Photograph #12: Typical view of area where proposed new National Road gate access road will be located.

Photograph #13: Location where the proposed gate and turn lanes may be constructed on National Road.

Photograph #14: Parcourse located in the area of the proposed gate location.

Photograph #15: Stream 1 (see Figure 10), main drainage through the area for proposed National Road Gate.

Photograph #16: Stream 1 tributary (see Figure 10) in the area of the proposed National Road Gate.

Photograph #17: Stream 2 (see Figure 10) in the area of the proposed National Road Gate access road.

Photograph #18: Wetland 1 (from the south) located in the area of the proposed National Road Gate.

Photograph #19: Wetland 2 (from the southwest) located in the area of the proposed National Road Gate.

Photograph #20: Shagbark hickory (possible Indiana bat roosting habitat) in the wooded area near the proposed National Road gate.

Photograph #21: Sugar maple with large cavity (possible Indiana bat roosting habitat) in the wooded area near the proposed National Road gate.

Photograph #22: Typical view of area of proposed wastewater line improvement in the Downtown District, along G Street.

Photograph #23: Typical view of area of proposed wastewater line improvement in the Downtown District, along F Street.

Photograph #24: Typical view of area of proposed wastewater line improvement in the Hilltop District, south of Twelfth Street.

Appendix B
Correspondence with the
Ohio Department of Natural Resources

CH2M HILL
One South Main Street
Suite 1100
Dayton, Ohio 45402
Tel (937) 228-3180, ext. 267
Fax (937) 228-7572.

CH2MHILL

October 17, 2006

Debbie Woischke
Ohio Department of Natural Resources
Division of Natural Areas and Preserves
Natural Heritage Data Services
2045 Morse Road, Building F-1
Columbus, Ohio 43229-6693

Subject: Rare Species Data Request and Informal Consultation
Environmental Assessments
Wright Patterson AFB, Base Realignment and Closure Projects
Greene and Montgomery Counties, Ohio

Dear Ms. Woischke:

Wright-Patterson AFB is preparing two Environmental Assessments for several construction projects in support of missions that are being relocated to Wright Patterson AFB from other bases around the nation, as part of the 2005 Base Realignment and Closure (BRAC) recommendations. The sites of these projects are shown on the enclosed maps.

As part of these assessments, we would like to request the locations of known populations of rare, threatened and endangered species within a one mile radius of the project sites. For the Indiana bat, we would like to request information within a five mile radius. A Natural Heritage Data Request form is enclosed. We would also like to request informal consultation regarding the possible impacts of the projects on species listed as threatened or endangered in accordance with Section 7 of the Endangered Species Act.

The attached map taken from the Base General Plan identifies the projects. Projects 1, 2 and 3 are the subject of the first Environmental Assessment, and involve infrastructure upgrade projects (i.e., utilities, communications, and roadways). These projects would largely occur along existing roadways.

The remaining projects are the subject of the second Environmental Assessment. Projects 4 through 6, 10 and 13 involve new building construction or additions to existing buildings on primarily open mowed fields/lawns. Projects 7 through 9 are interior renovations of existing structures. Projects 11 and 12 (two alternative sites for one project) involve minor site improvements for mobile medical facility training. The Project 11 site is an unmowed open field with some perimeter woodland, and the Project 12 site is a mowed field with some woodland.

Debbie Woischke
BRAC Environmental Assessments
October 17, 2006

Thank you for your consideration. Please contact me at (937) 228-3180, ext 267 if you have any questions.

Sincerely,

Robert Hook
Project Planner

Copy: Karen Beason (88 ABW/CEVO, WPAFB)

Enclosures: USGS quadrangle map
2004 Aerial Photo map
General Plan, BRAC 2005: General Areas of Proposed Actions and Alternatives

NATURAL HERITAGE DATA REQUEST

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF NATURAL AREAS AND PRESERVES
OHIO NATURAL HERITAGE PROGRAM
2045 MORSE ROAD, BUILDING F-1
COLUMBUS, OHIO 43229
PHONE: 614-265-6453; FAX: 614-267-3096

INSTRUCTIONS:
Please fill out both sides of this data request form, sign it and return it to the address or fax number listed above along with: **(1)** a letter formally requesting data and describing your project, and **(2)** a map detailing the boundaries of your study area. A photocopy from the pertinent portion of a USGS 7.5 minute topographic map is preferred but other maps are acceptable. Our turnaround time is two weeks, although we can often respond more quickly.

FEES:
Fees are determined by the amount of time it takes to complete your project. The charge is $25.00 per ½ hour with a ½ hour minimum. We can perform a data search manually or by computer. The Heritage Data Services staff will determine the most cost-efficient method of doing your search. A cost estimate can be provided upon request. Unless otherwise specified, an invoice will accompany the data services response.

****

This request is being submitted by: ☐ fax ☒ mail ☐ both

Date: October 13, 2006

Agency/Organization: CH2M HILL

Name/Title: Robert Hook, Project Planner

Address: One South Main Street, Suite 1100

City/State/Zip: Dayton, Ohio 45402

Phone/Fax: 937-228-3180 ext. 267 (voice) 937-228-7572 (fax)

Project Name/Number: BRAC Environmental Assessments, Wright Patterson AFB

Project is located on the following USGS 7.5 minute topographic map(s):

Yellow Springs and Fairborn, OH

If there is a program or contracting agency requiring this information, please give the name and phone number of a contact person:

Karen Beason, Wright Patterson AFB, Environmental Management, (937) 257-5899

The Natural Heritage Data Base contains records for the categories of species and features listed below. Check the appropriate boxes to indicate your selection.

PLANTS:
- ☐ Federal Status Only
- ☐ State Legal Status Only
- ☐ Rare (non-legal status)
- ☒ All of the above

ANIMALS:
- ☐ Federal Status Only
- ☐ State Legal Status Only
- ☐ Rare (non-legal status)
- ☒ All of the above

PLANT COMMUNITIES:
- ☒ All
- ☐ Wetlands Only
- ☐ Other_____

OTHER FEATURES:
- ☐ Geologic Features
- ☐ Breeding/Non-breeding Animal Concentrations
- ☐ State Nature Preserves and Natural Areas
- ☐ State Wild, Scenic and Recreational Rivers
- ☐ State Parks, Forests, Wildlife Areas
- ☒ All of the above
- ☐ Other_____

Besides name, location and status, specify any additional information you need:

_____

_____

The area you want searched:
- ☐ study area as outlined on the map
- ☐ study area plus ½ mile radius
- ☒ study area plus 1 mile radius
- ☒ other Indiana bat captures within 5 mile radius of project study area

How will the information be used:

The information will be referenced in an Environmental Assessment. Precise locations of any listed species will not be refererecened in the documents, but only the distance of the project from the sites, as necessary.

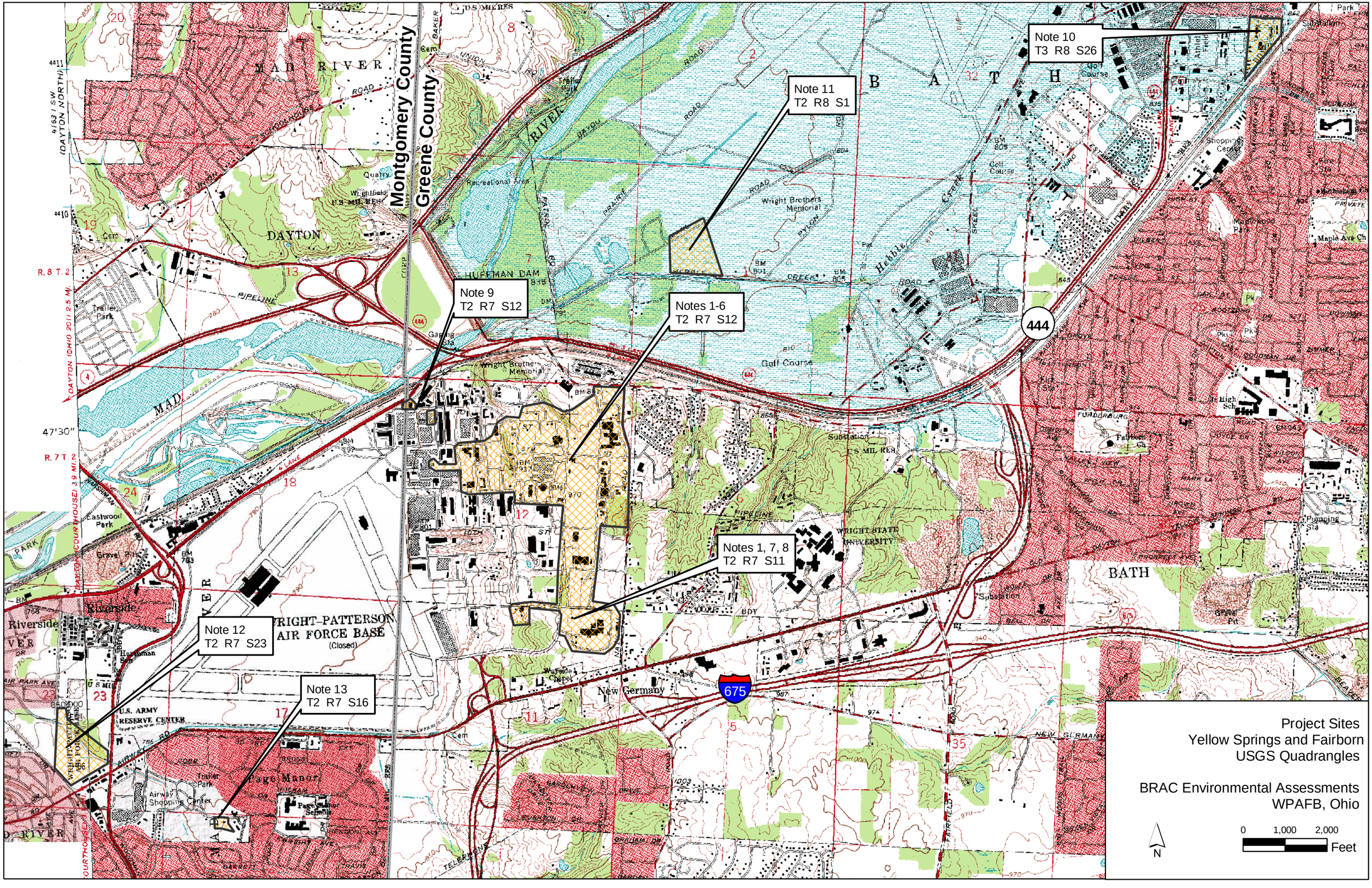
_____

_____

The information supplied above is complete and accurate. Any materials or digital data supplied by the Natural Heritage Database will not be published without prior written permission and without crediting the Division of Natural Areas and Preserves as the source. Electronic data sets may not be distributed to third parties without the written permission of the Division of Natural Areas and Preserves

Signature 

DNR 5203
REV 9/97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T3 R8 S26
Note 11
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Note 9
T2 R7 S12
Notes 1-6
T2 R7 S12
Notes 1, 7, 8
T2 R7 S11
Note 12
T2 R7 S23
Note 13
T2 R7 S16
Montgomery County
Greene County
MAD RIVER
DAYTON
BATH
Riverside
WRIGHT-PATTERSON AIR FORCE BASE
(Closed)
New Germany
444
675
Project Sites
Yellow Springs and Fairborn
USGS Quadrangles
BRAC Environmental Assessments
WPAFB, Ohio
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Montgomery County
Greene County
Note 9
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Note 11
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Notes 1, 7, 8
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Note 12
T2 R7 S23
Note 13
T2 R7 S16
675
Project Sites
2004 Aerial Photo
BRAC Environmental Assessments
WPAFB, Ohio
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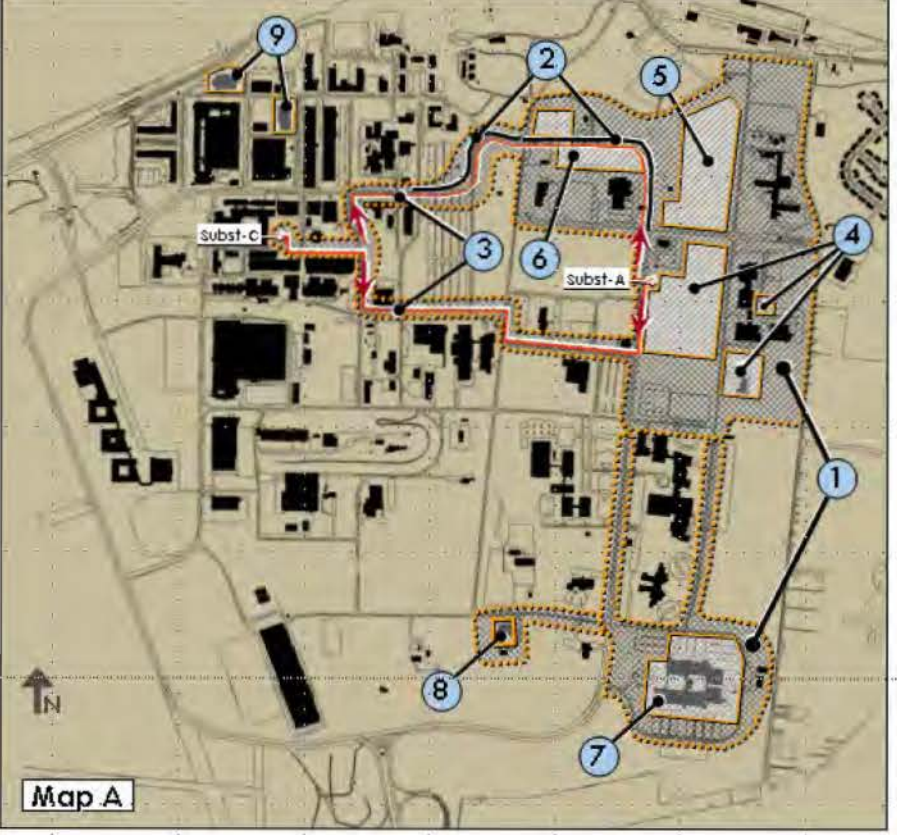
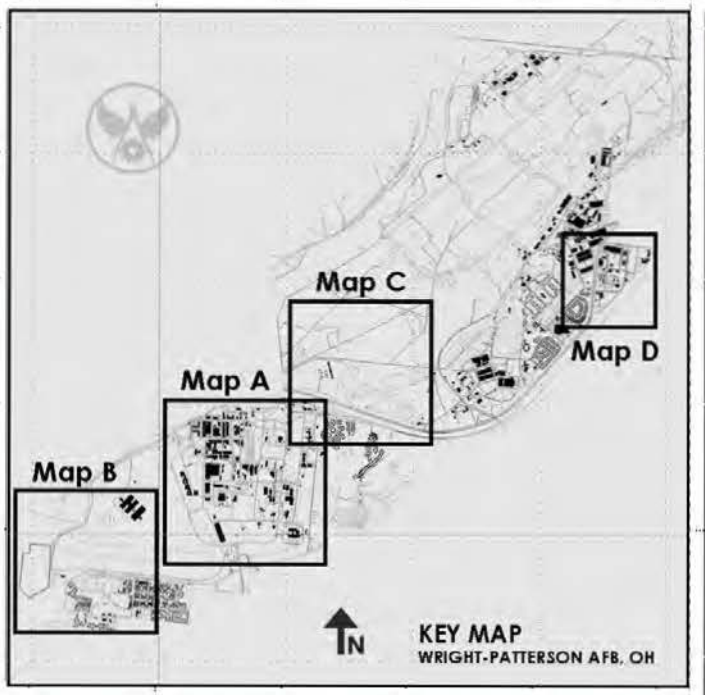
BRAC 2005 : GENERAL AREAS OF PROPOSED ACTIONS AND ALTERNATIVES

88ABW/CECX WRIGHT - PATTERSON AFB, OHIO



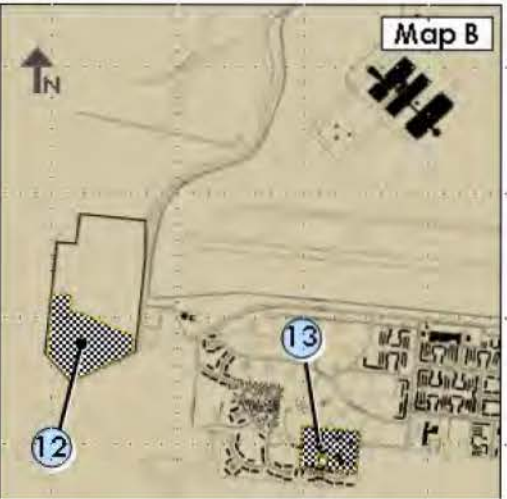


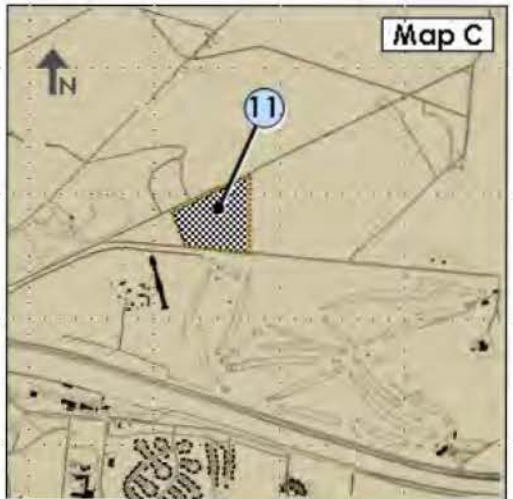
KEY NOTES:

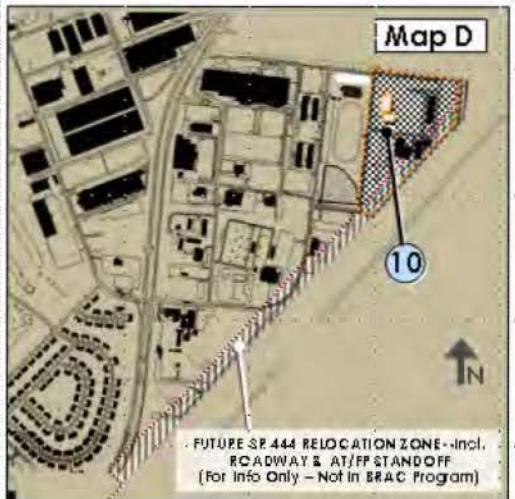
1. Upgrade Area B Utilities/Communications Infrastructure to support BRAC Projects
2. Upgrade Area B Roadways Infrastructure to support BRAC Projects
3. New Underground Tie Circuit between Electrical Substations A and C following either a North or South Connection Route
4. War Fighter Readiness, Biosciences, & Aerospace Medical Research Campus (AFRL/HE & NAMRL)
5. USAF School of Aerospace Medicine & Aerospace Medicine Consultation Campus (USAFSAM)
6. Air Force Institute of Operational Health (AFIOH)
7. Renovate/Expand Bldg 20820 (AFRL/SN)
8. Renovate Bldg 20470/20758 for Alternate Radiation Calibration Facility (AFIOH)
9. Renovate Bldgs 20012 & 20017 (HSG/YA and Fixed Wing Development & Acquisition)
10. Pipeline Student Dorm and Fitness Facility Development Area (USAFSAM)
11. Field Training Site - Alternative 1 (USAFSAM)
12. Field Training Site - Alternative 2 (USAFSAM)
13. Addition to Religious Ed Center, Bldg 20229

LEGEND

- EXISTING FACILITIES
- GENERAL ASSESSMENT AREA FOR BRAC INFRASTRUCTURE UPGRADES
- NEW ROADWAY
- NEW UNDERGROUND ELECTRICAL
- PROPOSED BRAC FACILITY DEVELOPMENT SITES







Ohio Department of Natural Resources

BOB TAFT, GOVERNOR

SAMUEL W. SPECK, DIRECTOR

Division of Natural Areas and Preserves
Bob Gable, Acting Chief
2045 Morse Rd., Bldg. F-1
Columbus, OH 43229-6693
Phone: (614) 265-6453; Fax: (614) 267-3096

October 19, 2006

Robert Hook
CH2M Hill
One S. Main St., Suite 1100
Dayton, OH 45402

Dear Mr. Hook:

I have reviewed our Natural Heritage maps and files for the Wright Patterson Air Force Base Realignment and Closures project areas, including a one mile radius, in Mad River Township, Montgomery County and in Beaver Creek and Bath Townships, Greene County, and on the Yellow Springs and Fairborn Quads. I also performed a search for Indiana Bat (*Myotis sodalis*) records within a five mile radius of the project areas. The numbers/letters on the list below correspond to the areas marked on the accompanying map. Common name, scientific name and status are given for each species.

Yellow Springs/Fairborn Quads

A. Huffman Metro Park - Five Rivers MetroParks (4 parcels)
B. Dayton Aviation Heritage National Historical Park - National Park Service
C. Cemex Reserve - Greene Co. Park District
1. *Bartramia longicauda* - Upland Sandpiper, threatened
2. *Carex mesochorea* - Midland Sedge, threatened
3. *Myotis sodalis* - Indiana Bat, state endangered, federal endangered
4. *Myotis sodalis* - Indiana Bat, state endangered, federal endangered
5. *Cistothorus platensis* - Sedge Wren, species of concern
   Papaipema beeriana - Beer's Noctuid, endangered
6. *Sistrurus catenatus* - Eastern Massasauga, endangered
7. *Sistrurus catenatus* - Eastern Massasauga, endangered
8. *Sistrurus catenatus* - Eastern Massasauga, endangered
9. *Vitis cinerea* - Pigeon Grape, potentially threatened
10. *Vitis cinerea* - Pigeon Grape, potentially threatened

There are no state nature preserves or scenic rivers at the project site. We are also unaware of any geologic features, breeding or non-breeding animal concentrations or state parks, forests or wildlife areas in the project vicinity.

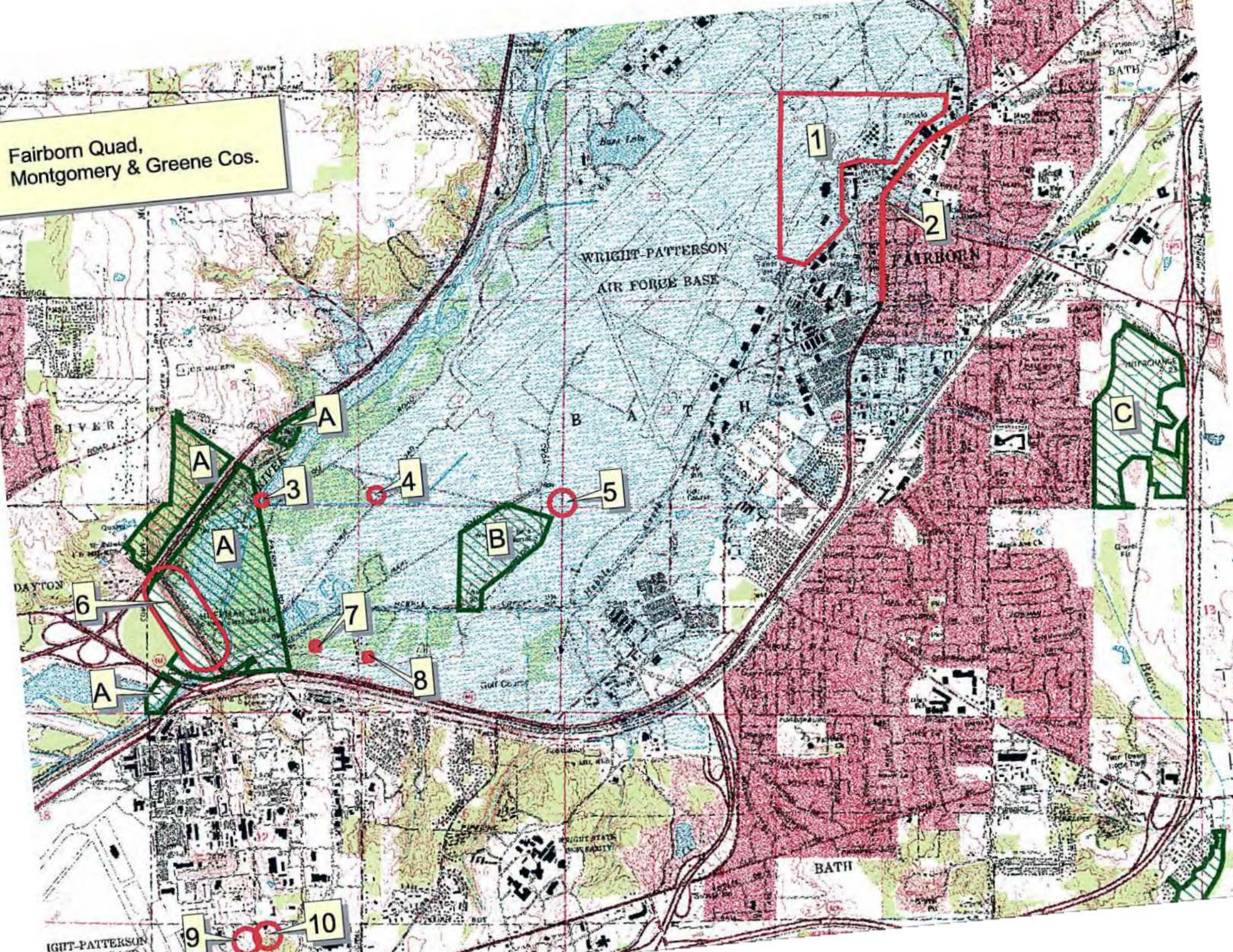
Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Please note that although we inventory all types of plant communities, we only maintain records on the highest quality areas. Also, we do not have data for all Ohio wetlands. For National Wetlands Inventory maps, please contact Madge Fitak in the Division of Geological Survey at 614-265-6576.

Please contact me at 614-265-6818 if I can be of further assistance.

Sincerely,

Debbie Woischke

Debbie Woischke, Ecological Analyst
Natural Heritage Program


Fairborn Quad,
Montgomery & Greene Cos.
WRIGHT-PATTERSON
AIR FORCE BASE
FAIRBORN
BATH
DAYTON
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2
3
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8
9
10
A
B
C

Appendix C
Correspondence with the
U.S. Fish & Wildlife Service

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 88TH AIR BASE WING (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

27 November 2006

88 ABW/CEVO Bldg 89
5490 Pearson Road
Wright-Patterson AFB OH 45433-5332

Dr. Mary Knapp
U.S. Fish and Wildlife Service
6950 Americana Pkwy
Suite H
Reynoldsburg, OH 43068-4127

Dear Dr. Knapp

The U.S. Air Force is seeking informal consultation with the U.S. Fish and Wildlife Service in compliance with Section 7 of the Endangered Species Act in support of multiple mission activities relocating to Wright-Patterson Air Force Base (WPAFB) as part of the Base Realignment and Closure (BRAC) 2005 decisions. WPAFB is currently preparing two Environmental Assessments (EAs) in support of the mission relocations. The proposed locations for these projects are shown on the attached maps.

The first assessment will address upgrading the Area B infrastructure providing adequate site utilities, communications, and roadways that will support multiple mission activities relocating WPAFB (Sites 1, 2, and 3 on attached map). The upgrades would largely occur along existing roadways.

A second assessment will address plans to construct new facilities, renovate existing facilities and evaluate locations associated with support functions for the multiple mission activities relocating to WPAFB from other bases around the nation. Site locations 4 through 6, 10 and 13 involve new building construction or additions to existing buildings on primarily open mowed fields/lawns. Sites 7 through 9 are interior renovations of existing structures. Sites 11 and 12 (two alternative sites for one project) involve minor site improvements for mobile medical facility training. Site 11 is an unmowed open field with some perimeter woodland, and site 12 is a mowed field with some woodland.

Thank you for your consideration. Please contact me at (937) 257-5899 or by email at karen.beason@wpafb.af.mil if you have any questions.

Sincerely

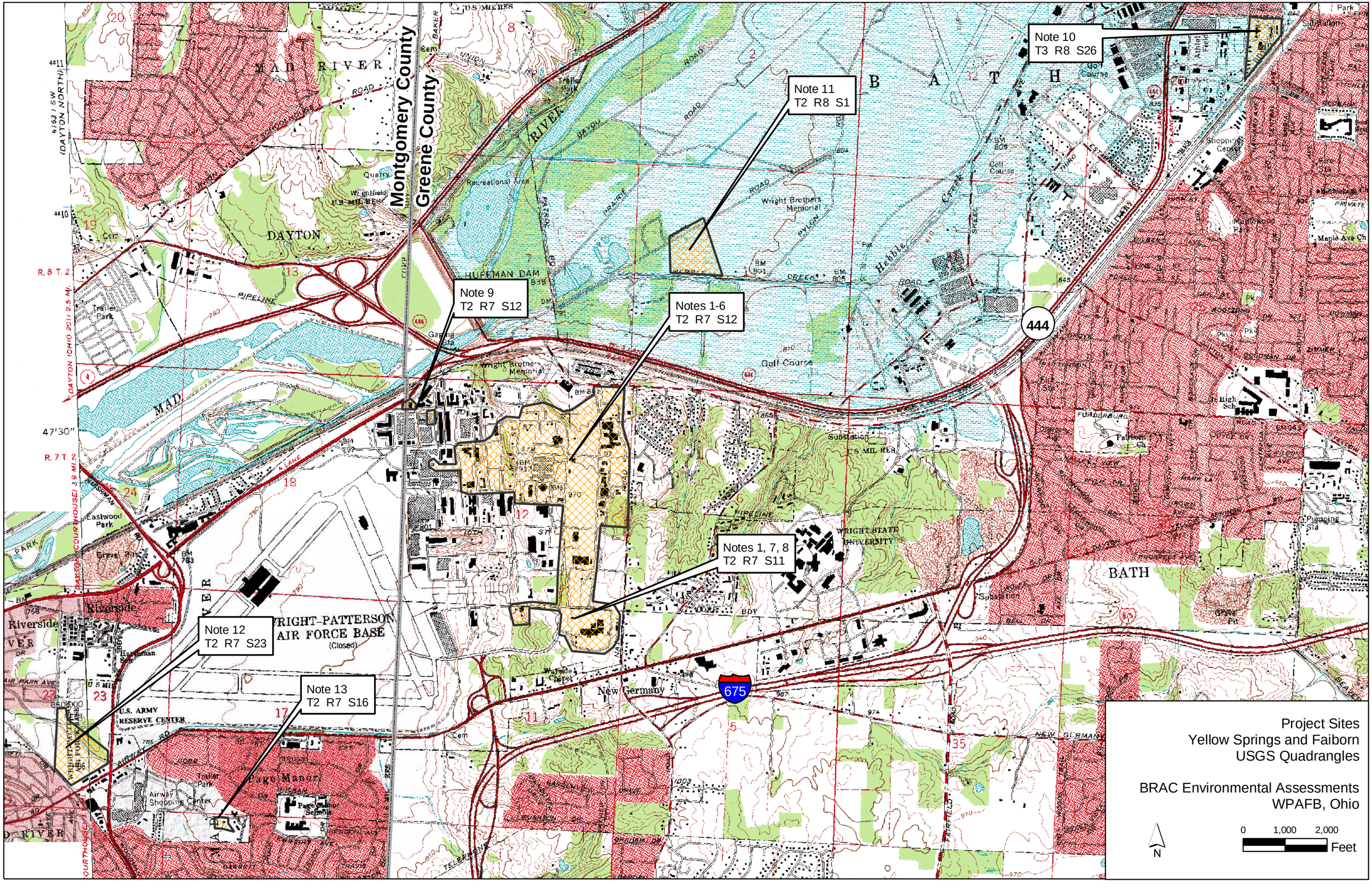
Karen N. Beason

Karen N. Beason
Operations Branch
Environmental Management Division

cc: Suzette Cortina/CH2M HILL

Attachments:

1. USGS Quadrangle Map
2. 2004 Aerial Photo Map
3. General Areas of Proposed Actions and Alternatives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T2 R8 S1
Note 9
T2 R7 S12
Notes 1-6
T2 R7 S12
Notes 1, 7, 8
T2 R7 S11
Note 12
T2 R7 S23
Note 13
T2 R7 S16
Montgomery County
Greene County
MAD RIVER
DAYTON
HUFFMAN DAM
Wright Brothers Memorial
Golf Course
BATH
WRIGHT-PATTERSON AIR FORCE BASE
(Closed)
U.S. ARMY RESERVE CENTER
Riverside
Page Manor
New Germany
444
675
Project Sites
Yellow Springs and Faiborn
USGS Quadrangles
BRAC Environmental Assessments
WPAFB, Ohio
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Feet


Montgomery County
Greene County
Note 9
T2 R7 S12
Notes 1-6
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Note 10
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Note 11
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T2 R7 S11
Note 12
T2 R7 S23
Note 13
T2 R7 S16
675
Project Sites
2004 Aerial Photo
BRAC Environmental Assessments
WPAFB, Ohio
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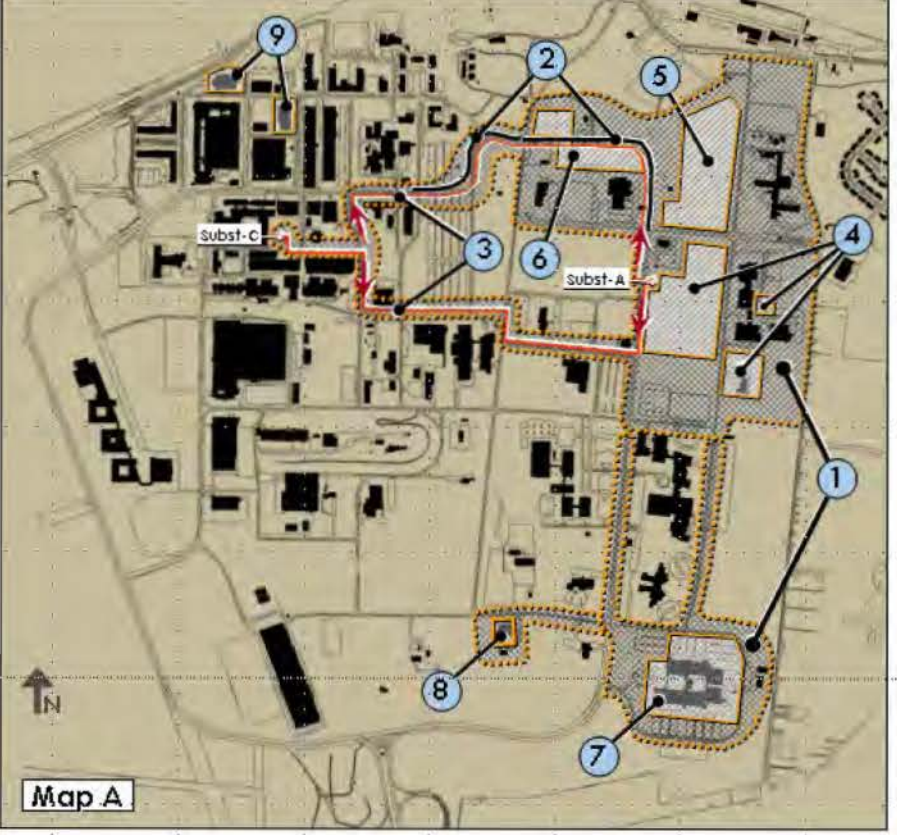
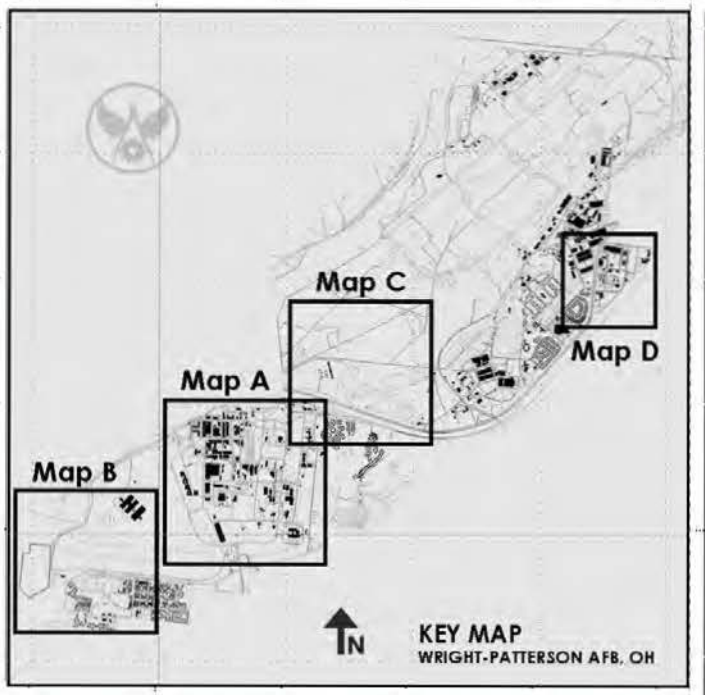
Feet

BRAC 2005 : GENERAL AREAS OF PROPOSED ACTIONS AND ALTERNATIVES

88ABW/CECX WRIGHT - PATTERSON AFB, OHIO





KEY NOTES:

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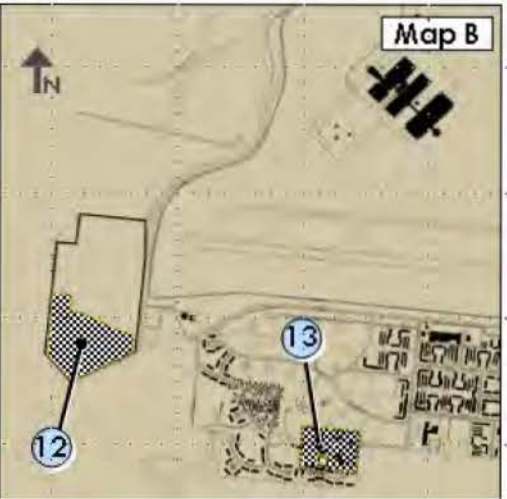
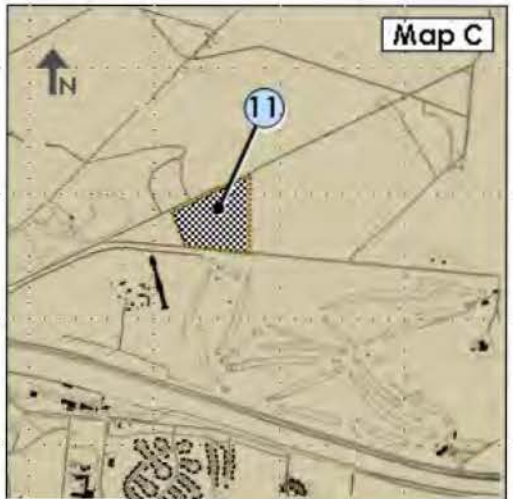
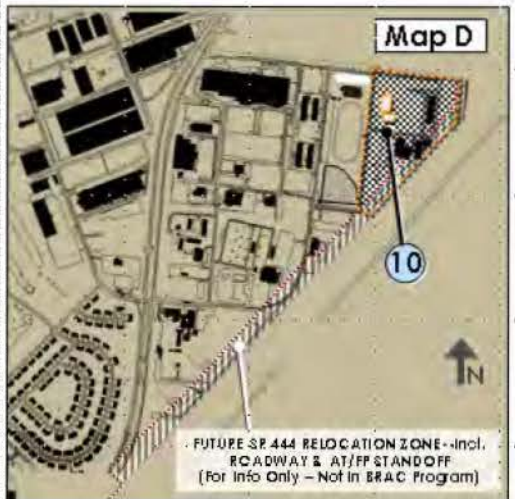
10. Pipeline Student Dorm and Fitness Facility Development Area (USAFSAM)
11. Field Training Site - Alternative 1 (USAFSAM)
12. Field Training Site - Alternative 2 (USAFSAM)
13. Addition to Religious Ed Center, Bldg 20229

LEGEND

- EXISTING FACILITIES
- GENERAL ASSESSMENT AREA FOR BRAC INFRASTRUCTURE UPGRADES
- NEW ROADWAY
- NEW UNDERGROUND ELECTRICAL
- PROPOSED BRAC FACILITY DEVELOPMENT SITES







United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

(614) 469-6923/FAX (614) 469-6919

January 23, 2007

Karen Beason
88 ABW/CEVO Bldg 89
5490 Pearson Road
Wright-Patterson AFB, OH 45433

TAILS: 31420-2007-I-0089

Dear Ms. Beason,

The U.S. Fish and Wildlife Service (Service) has reviewed your November 27, 2006 letter regarding preparation of two Environmental Assessments in support of mission activities relocating at Wright-Patterson Air Force Base (WPAFB) in Montgomery and Greene Counties, Ohio. The first assessment will address upgrading infrastructure and will occur largely along existing roadways. The second assessment includes plans for new construction and may occur in undeveloped areas (unmowed fields and woodlands).

Through the INRMP process it was determined that four federally listed species may occur at WPAFB. These species include the Indiana bat *(Myotis sodalis)*, bald eagle (*Haliaeetus leucocephalus*), clubshell mussel (*Pleurobema clava*), and Eastern massasauga (*Sistrurus catenatus*). Based on the information provided in your letter, the Indiana bat and Eastern massasauga may be affected. Below is information about each of these species.

The proposed project lies within the range of the **Indiana bat**, a Federally-listed endangered species. Known locations for this species occur within your project area. Since first listed as endangered in 1967, their population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat, including the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines. Summer habitat requirements for the species are not well defined but the following are considered important:

1. Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas.

2. Live trees (such as shagbark hickory and oaks) which have exfoliating bark.

3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

The Service recommends that project designs maintain as many trees and forested habitat shrub/scrub habitat as possible along all property lines and along edges of developed areas by minimizing footprint of graded areas, roads, and staging areas to the maximum extent practicable. Should the proposed site contain trees or associated habitats exhibiting any of the characteristics listed above, we recommend that the habitat and surrounding trees be saved wherever possible. If

the trees must be cut, further coordination with this office is requested to determine if surveys are warranted. Any survey should be designed and conducted in coordination with the Endangered Species Coordinator for this office.

The project lies within the range of the **eastern massasauga**, a docile rattlesnake that is declining throughout its national range and is currently a Federal Candidate species. The snake is currently listed as endangered by the State of Ohio. Your proactive efforts to conserve this species now may help avoid the need to list the species under the Endangered Species Act in the future. Due to their reclusive nature, we encourage early project coordination to avoid potential impacts to massasaugas and their habitat. At a minimum, project evaluations should contain delineations of whether or not massasauga habitat occurs within project boundaries. The massasauga is often found in or near wet areas, including wetlands, wet prairie, or nearby woodland or shrub edge habitat. This often includes dry goldenrod meadows with a mosaic of early successional woody species such as dogwood or multiflora rose. Wet habitat and nearby dry edges are utilized by the snakes, especially during the spring and fall. Dry upland areas up to 1.5 miles away are utilized during the summer, if available. For additional information on the eastern massasauga, including project management ideas, please visit the following website: http://www.fws.gov/midwest/Endangered/lists/candidat.html or contact this office directly.

The proposed project also lies within the range of the **bald eagle** and **clubshell mussel**. Due to the lack of suitable habitat, no impacts to these threatened and endangered species are anticipated. Relative to these two species, this concludes consultation on this action as required by section 7(a)(2) of the Endangered Species Act. Should, during the term of this action, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with the Service should be reinitiated to assess whether the determinations are still valid.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973, as amended, and are consistent with the intent of the National Environmental Policy Act of 1969 and the U. S. Fish and Wildlife Service's Mitigation Policy. Please note that consultation under section 7 of the ESA may be warranted for this project if suitable habitat for the Indiana bat may be impacted by this project. This letter provides technical assistance only and does not serve as a completed section 7 consultation document.

If you have questions, or if we may be of further assistance in this matter, please contact Sarena Selbo at extension 17 in this office.

Sincerely,

Mary Knapp

Mary M. Knapp, Ph.D.
Supervisor

cc: ODNR, Div. of Wildlife, SCEA Unit, Columbus, Ohio

Appendix D
USACE Mitigation Guidelines and Checklist for the State of Ohio

US Army Corps of Engineers
Huntington District

Public Notice

In reply refer to:	Issuance Date:
Public Notice No. 200400008-OH	September 23, 2004
Stream: n/a	Expiration Date: n/a
Address comments to:	US Army Corps of Engineers, Huntington District 502 Eighth Street ATTN: CELRH-F Huntington, West Virginia 25701-2070

U.S. Army Corps of Engineers
Mitigation Guidelines
Checklist for the State of Ohio

The U.S. Army Corps of Engineers (USACE) published the following public notices to request comments on proposed mitigation guidelines to be administered as part of the Corps' Regulatory Program: 1) Huntington District Public Notice No. 200400008 dated January 30, 2004, 2) Pittsburgh District Public Notice No. 03-MAP1 dated December 15, 2003, 3) Buffalo District Public Notice No. 200400250 dated December 15, 2003, and 4) Louisville District Public Notice – "Louisville District Mitigation Guidelines" dated December 15, 2003. This effort is part of the National Mitigation Action Plan to improve the success of compensatory mitigation on a nationwide basis and to provide a measure of consistency in mitigation requirements and policy for the regulated community. Due to comments and concerns submitted by state and federal agencies and the general public, the Huntington, Louisville, Pittsburgh and Buffalo Districts worked together and developed a final checklist for the state of Ohio (attached).

This compensatory mitigation checklist was developed as a technical guide intended to clarify provisions within existing authorities and does not establish new requirements. This checklist shall be used in conjunction with the national Mitigation Plan Checklist and Supplement, the national guidance entitled "Incorporating the National Research Council's Mitigation Guidelines Into the Clean Water Act Section 404 Program" and the Regulatory Guidance Letter 02-02. This document provides a framework of the basic information required in preparing a compensatory mitigation plan. All information outlined in the checklist may not be required for each project. However, the Corps of Engineers will review all projects on a case-by-case basis and in some instances may request additional information.

Compensatory mitigation is not a substitute for compliance with the existing Memorandum of Agreement (MOA) between the United States Environmental Protection Agency and USACE concerning mitigation considered under Section 404 of the Clean Water Act (33 CFR Part 1344). The purpose of compensatory mitigation is to replace those aquatic ecosystem functions that would be lost or impaired as a result of a USACE authorized activity. The type and amount of compensatory mitigation required will be commensurate with the nature and extent of the activity's adverse impacts on aquatic functions. Compensatory mitigation may include the restoration, enhancement, creation, and/or preservation of streams, wetlands and other aquatic resources. Compensatory mitigation should generally be "in-kind" and occur as close to the site of the adverse impact as practicable in order to minimize losses to the local aquatic ecosystem. However, out-of-kind and/or off-site compensation may be appropriate when compensation either cannot reasonably be conducted in-kind and/or at the impact site or would be more beneficial to the aquatic ecosystem if conducted out-of-kind or at another location. If in-kind/out-of-kind mitigation can not be accomplished on-site or off-site, and all possibilities have been exhausted or a greater environmental benefit would be realized, the applicant may use an approved mitigation bank or participate in an approved in-lieu fee arrangement if those opportunities are available.

Please be aware additional authorization and/or information may be required by the Ohio Environmental Protection Agency (OEPA). You may contact the OEPA at:

Name: Randy Bournique
Address: Ohio Environmental Protection Agency
Division of Surface Water
PO Box 1049
Columbus, Ohio 43215
Phone: 614-644-2001

Appendices will be available by hard copy or online by October 30, 2004. Additional information concerning the mitigation plan checklist may be obtained by contacting:

HUNTINGTON DISTRICT
Sarah Workman
U.S. Army Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
304-399-5710

PITTSBURGH DISTRICT
Scott Hans
U.S. Army Corps of Engineers, Pittsburgh District
William S. Moorhead Federal Building
1000 Liberty Avenue
Pittsburgh, Pennsylvania 15222-4186
412-395-7155

LOUISVILLE DISTRICT
James Townsend
U.S. Army Corps of Engineers, Louisville District
P.O. Box 59
Louisville, Kentucky 40201-0059
502-582-6461

BUFFALO DISTRICT
Theresa Hudson
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, NY 14207
716-879-4330

Ginger Mullins, Chief
Regulatory Branch

(O)

U.S. Army Corps of Engineers
Compensatory Mitigation Guidelines
Final Checklist for the State of Ohio

I. Overall Mitigation Goals and Objectives

The goals of mitigation must be clearly stated in the mitigation plan. The basic purpose of compensatory mitigation is the functional replacement of wetland or stream functions and values that are lost through construction of a permitted activity. Typically the objective is to provide a minimum of 1:1 functional replacement, i.e. no net loss of functions, with an adequate margin of safety to reflect anticipated success. Individual state requirements may differ. In some cases, a larger mitigation ratio may be needed to adequately replace the functions of those aquatic resources impacted by development. Goals of a mitigation site must be specific, measurable, and attainable within a specified timeframe.

A. Summarize the overall objectives in terms of the water regime, vegetation structure, and habitat features to be restored, created, or enhanced.

B. Summarize the overall functions lost at the impact site and overall functions to be gained at the proposed mitigation site.

C. Summarize the aquatic resource type and functions for which the mitigation project is intended to compensate.

II. Baseline Information of Proposed Impact Site and Proposed Mitigation Site

A. Location

1. Include a road map, USGS map, NWI map, NRCS County soil map, FEMA map, zoning or planning map and aerial photography/satellite imagery depicting the geographic relationship between the proposed impact site(s) and the proposed mitigation site(s).
2. Provide identification coordinates of proposed impact and mitigation site(s) in latitude/ longitude (decimal format), township, county and Hydrologic Unit Code (HUC).

B. Impact Site

1. Describe and quantify the aquatic resource type (i.e. acreage of wetlands/ponds, length of stream) proposed to be impacted. This should be detailed and should provide such information as whether a wetland is emergent, scrub-shrub, forested or a combination of two or more of these classes. Stream classifications should be provided based on Cowardin or Rosgen techniques or other forms of stream classifications. Include temporary and permanent impacts to the aquatic environment.
2. Describe both site specific and landscape level wetland or stream functions and values at each impact site using parameters in an approved functional

assessment method for the region. These described functions will dictate the minimum functions that must be replaced at the proposed mitigation site.

3. For all waters proposed to be impacted, provide a detailed discussion of the existing surrounding upland buffers. This description should document the width of buffers, as well as the quality and denseness of buffers (i.e. the percent cover of each vegetative stratum).

C. Overall Watershed Improvements

1. Describe aquatic resource concerns in the watershed (e.g. flooding, water quality, habitat) and how the impact site contributes to overall watershed/regional functions. When available, identify watershed or other regional plans that describe aquatic resource objectives.
2. Describe the contribution to overall watershed/regional functions that the mitigation site(s) is intended to provide.

D. Proposed Mitigation Site

1. Provide name, location and detailed drawing of the proposed mitigation site.
2. Provide names, addresses, and telephone numbers for all responsible parties including but not limited to: landowner(s), developer(s), consultant(s), and engineer(s).

E. Physical Attributes of Mitigation Site

1. Describe overall project including size, type, functions and amount of impact to aquatic and other resources. Provide a delineation of all aquatic resources present. Provide length of project reach.
2. Describe both site specific and landscape level wetland or stream functions and values to be enhanced or restored using parameters in an approved functional assessment method for the region. Assess the stream condition (aggrading, degrading, migrating excessively, excessive erosion, excess sediment in system, etc).
3. Describe existing soils through a soil profile description (e.g., soil survey classification and series) and/or stream substrate (locate soil samples on site map). Include results of standard soils analyses, including percent organic matter, structure, texture, and permeability.
4. Include photographs of aquatic resources in their current state, including upstream and downstream areas for streams.
5. Provide bed material type, sinuosity, valley slope, stream slope, thalweg details, pool to pool spacing, width to depth ratios, and other technical measurements or ranges, including watershed size and discharge of stream, if applicable.
6. Describe historic and current land use of proposed mitigation site and adjacent areas (i.e. prior converted cropland).
7. Describe watershed context/surrounding land use in terms of impairment status or type, general watershed land uses, landscape connectivity, and relative amount of aquatic resource area the site represents for the watershed and/or region.

8. Provide a plan view and section view drawings of existing conditions, and longitudinal profile.

III. Mitigation Site Selection & Justification

A. Existing Conditions

1. Describe location, including rationale for choice of mitigation site.
2. Indicate present property owner and availability of property.
3. Indicate distance from project site, if mitigation is offsite. Indicate if mitigation is in or out of the same watershed as impact site. If the proposed mitigation is off-site and/or out-of-kind, explain why on-site or in-kind options are not practicable or environmentally preferable.
4. Indicate history of previous land use and adjacent areas including development, field tiling, channelization, stream relocation, ditching, etc. Discuss non-native landscape plantings, pipelines, power lines, roads, distance and location to nearest structures, if any.
5. Provide any letters received from federal or state resource agencies in reference to the proposed site (i.e. U.S. Fish and Wildlife Service, DNR, SHPO, etc.).

B. Future Sustainability

1. Discuss future use of mitigation site and compatibility after project is complete.
2. Indicate any existing conservation easements, deed restrictions, encroachments, or rights-of-way. Demonstrate how any restrictions would be addressed.
3. Explain how the design is sustainable and self-maintaining.
4. Provide evidence that an adequate and reliable source of water exists. Can be described by means of a water budget or overall written description.
5. Indicate what entity, if any, controls the water flow and the water control structures to and/or from the site. Arrangements must be made by the applicant that guarantees appropriate water flow in the mitigation area during and after the establishment of the mitigation project. The agreement must be in writing and submitted to the Corps for review.

IV. Mitigation Work Plan

A. Site Preparation

1. Indicate parties responsible for construction.
2. Provide base topographic maps including project name, general location, application number, scale, elevations, north arrow, designer name, date of design, and existing features.
3. Provide representative cross-sections of mitigation site including elevations and scale.
4. Provide site preparation plan including permanent or temporary work areas, waste and structure removal, utility relocation, etc.
5. Describe Storm Water Pollution Prevention Plan, grading plan, and timing of construction to minimize impacts (i.e. seasonal). Work in waters must be

conducted during low flow, when practicable, to minimize the release of sediments.

6. Indicate type of equipment, construction techniques and protective barriers to be utilized. High visibility construction fencing should be placed along permit area perimeter and around existing resources to be protected during construction.
7. Include a description of techniques used to eradicate existing invasive vegetation. Describe method for disposal of excavated soil from mitigation site.
8. List other required permits for mitigation construction.
9. Provide plans to control site hydrology (i.e. cofferdam, dewatering, pumping, temporary drainage construction) during construction.

B. Timing

1. Describe timing of mitigation: before, concurrent or after authorized impacts. If mitigation is not in advance or concurrent with impacts, explain why it is not practicable and describe other measures to compensate for temporal losses.
2. Provide a description of the construction sequence indicating anticipated start date, duration and completion of construction.

C. Wetland Design Specifications and Characteristics

1. Provide plan view drawing including: topography, microtopography, basin depths, normal water elevation, area of cut and fill, berm construction, water control structures (if any), spillways, location of habitat structures, water quality improvement features and other features where applicable.
2. Provide typical cross sections including basin slopes, normal water depth, high water depth, typical features, etc.
3. Describe micro features and heterogeneous topography.
4. Indicate each inundation area and provide the depth and slope.
5. Identify vegetation zones and species placement corresponding with inundation area (i.e. seasonally saturated, permanently inundated, etc.)
6. Identify location of monitoring stations and photo location direction.
7. Identify watershed size and water budget, if necessary.
8. Identify any planned upland or wetland habitat features including large woody debris, rock mounds, etc.

D. Stream Design Specifications and Characteristics

1. Provide plan view drawing indicating normal water elevation, ordinary high water elevation, topographic features, thalweg, sinuosity measurements, habitat enhancement features, etc.
2. Provide (grade) profile drawing including gradient, grade controls, grade elevations, grade limitations, etc.
3. Provide cross sectional (dimension) drawings including bankfull width and depth, floodplain width, flood-prone width, entrenchment ratio, etc.

4. Describe design and habitat features including: riffles, root-wads, root-mats, deflectors, etc. Indicate total cut and fill needed to reconfigure or create new channel. Indicate total rock fill to be used for habitat/stabilization structures.
5. Indicate flow rate, hydrologic flow regime, storm event flow characteristics, wetted perimeter, and other applicable engineering information.
6. Include biogeochemical information.
7. Provide stabilization features and soil and bank erosion rates, if applicable.
8. Indicate expected or existing canopy cover.

E. Vegetation Plan

1. Describe vegetation plan methods and any bioengineering techniques used.
2. Describe any expected volunteer native vegetation included in mitigation planning.
3. Provide a list of species to be seeded and planted, identified by scientific name, common name and indicator status. Use the current Regional USFWS *National List of Plant Species That Occur in Wetlands*. Vegetation may not consist of exotic or hybrid nursery species.
4. Provide transplanting plan including storage method, duration and handling.
5. Provide a detailed description of proposed species location within each varying habitat zone (i.e. short-term saturation, long-term saturation, draw-down zone and permanently flooded zone.) The proposed species establishment should coincide closely with the proposed hydrologic conditions in each zone of the wetland area.
6. Provide an invasive species control and/or management plan that describes the strategy to recognize and respond to the invasion of exotic vegetation. Contact the Corps of Engineers regulatory office for a listing of exotic or nuisance species.

F. Soils

1. Describe soil profile, soil type, name, stability, organic matter content, nutrients, redox potential, particle size, depth to impervious layer, etc.
2. List source of soils, erosion control, topsoil segregation and soil compaction measures.
3. Identify color and chart used (Munsell or Earth Colors) and year published.

G. Hydrology

1. Describe any manipulation of hydrology required for construction of the site.
2. Identify source of water (precipitation, overbank flooding, groundwater and connection(s) to existing tributary system.
3. Describe the frequency and duration of inundation and saturation (hydrologic regime). Designs that manipulate natural wetland and stream processes with engineered structures requiring frequent maintenance should be avoided.
4. Indicate anticipated hydrologic changes, hydroperiod, and existing monitoring data.

H. Buffers

1. Include the proposed buffer areas to protect stream and/or wetland.
2. Specify plant species to be included in the buffer area (vegetation plan).
3. Identify area of proposed buffer including length, width and other special features.

V. Performance Standards

A. Identify clear, precise, quantifiable parameters that can be used to evaluate the status of desired functions. These parameters shall include but are not limited to hydrological, vegetative, fauna and soil measures. (i.e. wetland acreage, plant richness, percent vegetation cover, water inundation/saturation levels).

B. Describe how performance measures will be used to verify the objectives identified have been obtained.

C. Set target values or ranges for the parameters identified and deadline for establishment.

D. Provide a summary of goals.

VI. Site Protection and Maintenance

A. Responsible Parties

List parties responsible and their role (i.e. site owner, easement owner, maintenance implementation). If more than one party, identify primary party.

B. Legal Protection

Provide evidence of long-term legal protection instruments i.e. conservation easement, fee simple donation, management contract with federal, state, or local conservation organization.

C. Maintenance Plan and Schedule

1. Describe planned maintenance activities including plant replacement, non-native plant control, measures to control predation/grazing of mitigation plantings, and temporary irrigation for plant establishment.
2. Describe plans for water structure inspection, fertilization, erosion control, herbivore protection, trash removal, and/or any other maintenance activities.
3. Include protective measures such as signs, easements, land use management, fencing and access control.
4. Provide schedule for planned inspections and maintenance activities.

VII. Monitoring Plan

A. Monitoring Report Content

1. Provide a monitoring schedule.
2. List parties responsible for monitoring. If more than one, identify primary party.

3. Provide as-built plan including elevations in mitigation areas, water level elevations, and acreage of wetland/open water. Explain any deviations from the approved mitigation plan.
4. Provide maps identifying monitoring stations, transects, planting zones, etc., as appropriate.
5. Include analysis of all quantitative monitoring data (success, failure, and remedial action).
6. Include photos taken during each monitoring period. Photos shall be taken from the same vantage point and in the same direction every year, and shall reflect material discussed in the monitoring reports. When percent cover or other parameters are referenced, photographs should be taken of the sampling quadrants or transects.
7. Indicate results of any qualitative monitoring of site characteristics, functions, and values.
8. Report on performance standards success or failure.
9. Suggest remedial activities for characteristics functions or values that do not meet the success criteria (Adaptive Management Plan).

B. Timing: As-built plans shall normally be submitted within 60 days following completion of construction. The first monitoring report shall generally be due one year after completion of mitigation construction. The site will be normally be monitored for a minimum of five years and monitoring reports must be submitted yearly to the Corps. Failure to submit monitoring reports constitutes permit non-compliance.

C. Notification of Completion: Where appropriate, a current delineation of the mitigated wetland area or stream should be submitted with the final report. Following receipt of the final report, the Corps may require a site visit to verify the delineation and confirm completion of the mitigation effort.

VIII. Adaptive Management Plan

A. Identify responsible parties.
B. Identify remedial measures.
C. Initiate procedures for contingency measures.
D. Identify location for contingency mitigation.

IX. Financial Assurances

A. Financial assurances may be in the form of performance bonds, irrevocable trusts, escrow accounts, casualty insurance, letters of credit, or other approved instruments.
B. Financial assurances should be commensurate with the level of impact and the level of compensatory mitigation required. Financial assurances should be sufficient to cover contingency actions such as a default by the responsible party or a failure to meet performance standards.

Appendix E
State Historic Preservation Office
Coordination Letters

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 88TH AIR BASE WING (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

13 April 2007

88 ABW/CEVO, Bldg 89
5490 Pearson Road
Wright-Patterson AFB OH 45433-5332

Mr. Mark Epstein
Department Head, Resource Protection & Review
Ohio Historic Preservation Office
567 East Hudson Street
Columbus OH 43211-1030

Dear Mr. Epstein

This letter serves as advance notification of Base Realignment and Closure (BRAC) activities at Wright-Patterson Air Force Base (WPAFB) that will trigger Section 106 of the National Historic Preservation Act. We are currently preparing two Environmental Assessments (EA) to evaluate the environmental and cultural impacts of supporting multiple mission activities relocating to WPAFB as part of the BRAC 2005 decisions. The proposed locations for these projects are shown on the enclosed draft map (Attachment 1).

The first EA will address upgrading the Area B infrastructure providing adequate site utilities, communications, and roadways that will support multiple mission activities relocating to WPAFB (Site 1 on the attached map). The upgrades will largely occur along existing roadways and the only potential impact to historic resources is to the WPAFB Mound, Site #33 GR 31, which is currently listed on the NRHP. Measures will be taken to ensure the mound is not impacted by the infrastructure construction.

The second EA will address plans to construct approximately 700,000 square feet of new facilities, renovate approximately 300,000 square feet of existing facilities, and evaluate locations associated with support functions for the multiple mission activities relocating to WPAFB from other bases around the nation. Site locations 2, 3, 5, 6, 8, and 11 involve new building construction or additions to existing buildings on primarily open mowed fields/lawns. Site 4 is interior renovation of existing structures. Sites 7, 9, and 10 (three alternative sites for one project) involve minor site improvements for mobile medical field training.

Buildings 20012, 20017, and 20620 have been selected to fill some of the administrative and laboratory space needs of the inbound missions. It has been proposed that Buildings 20012 and 20017 be completely renovated including exteriors, interiors, building systems, and moderate demolition work. An addition to Building 20620 has been proposed. Facilities 20012 and 20017 are contributing buildings to the Wright Field Historic District. Additionally, Facilities 20012 and 20620 are individually eligible for the NRHP. The Ohio Historic Inventory Forms for these buildings are included in Attachment 2.

It is our intent that the design for the renovations/additions for Facilities 20012, 20017, and 20620 will be in keeping with the Secretary of the Interior's Standards and Guidelines for Historic Facilities. As

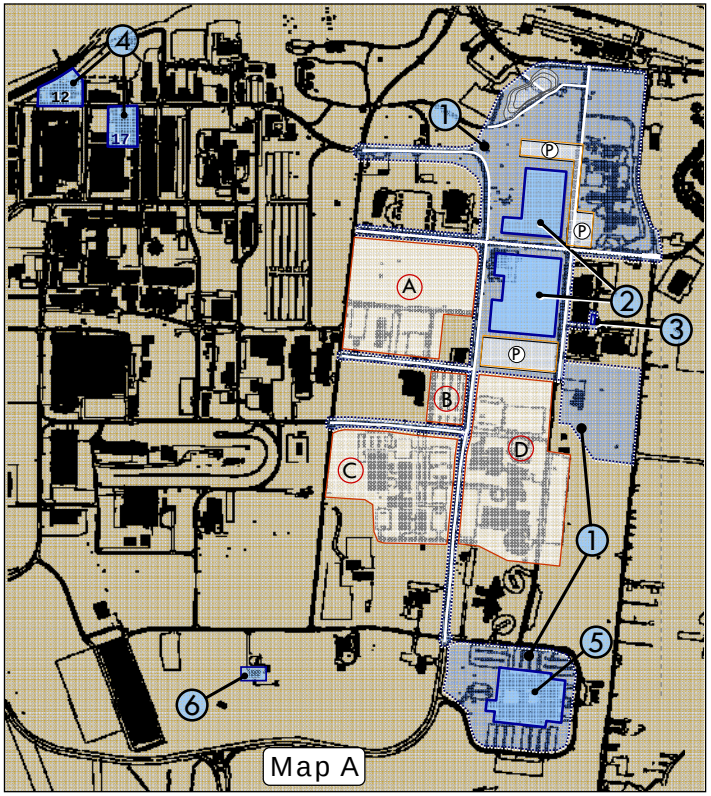
the EA's are completed and design documents drafted, these will be forwarded to your office for review and concurrence.

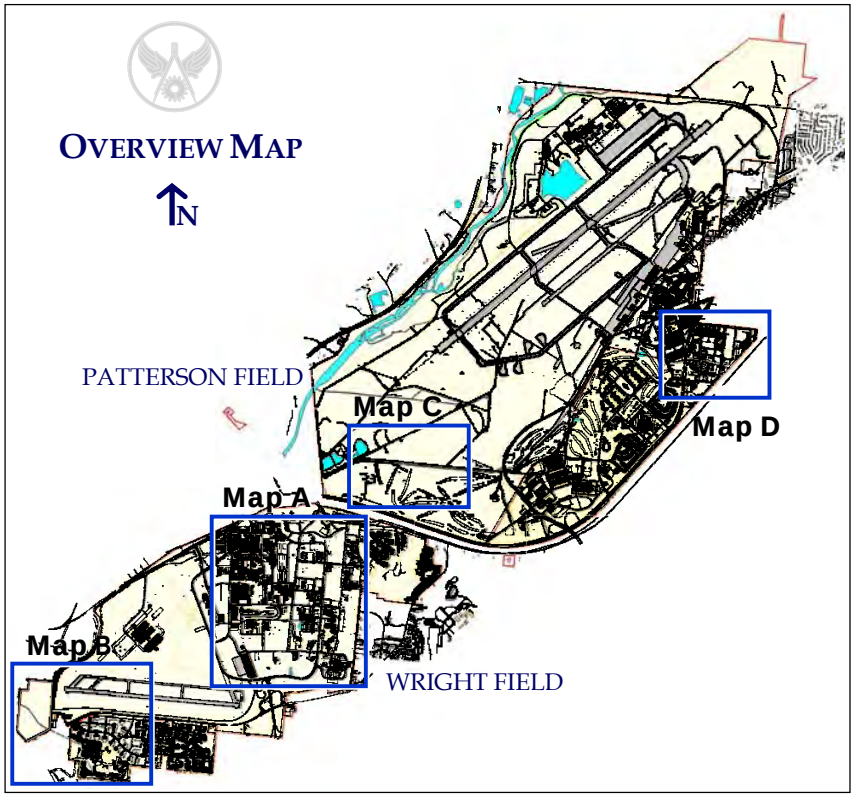
Should you have any comments or questions, I can be reached at (937) 257-0177, or via email at raymond.baker@wpafb.af..mil.

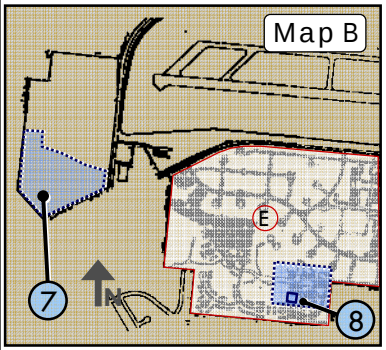
Sincerely

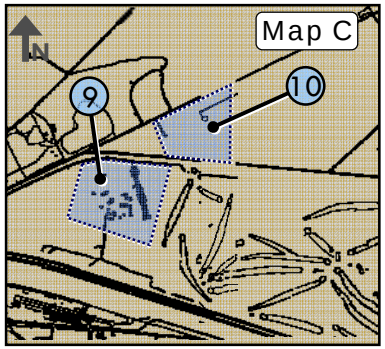
RAYMOND F. BAKER
Cultural Resources Program Manager
Operations Branch
Environmental Management Division

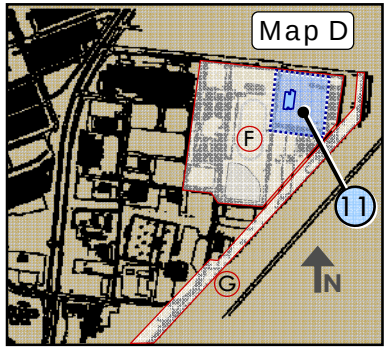
Attachments:
1. Draft BRAC Overview Map
2. Ohio Historic Inventory Forms for Buildings 20012, 20017, and 20620











LEGEND

- EXISTING
- BRAC GENERAL DEVELOPMENT AREA
- BRAC FACILITIES AREA
- (P) BRAC PARKING AREA
- CURRENT PLANNING INITIATIVES

BRAC MILCON

Proposed BRAC Project Sites:

1. Construct Transportation, Utilities, Storm Water Control, and Communications Infrastructure Upgrades
2. Construct Human Performance Wing (HPW) Campus Facilities for USAFSAM, AFIOH, NAMRL and AFRL
3. Construct Bldg 20838 Vivarium Addition
4. Renovate Bldgs 20012 & 20017 for HSG/YA and Fixed-Wing Development & Acquisition
5. Construct Bldg 20620 Addition/Alteration for AFRL/SN
6. Expand Hazardous Waste Storage Facility Bldg 20479 to Support HPW Operations
7. Establish USAFSAM Field Training Site - Alt 1/ Tillman Pit (Area B)
8. Construct Addition to Chapel Lane Religious Education Center, Bldg 20229
9. Establish USAFSAM Field Training Site - Alt 2/ 445AW Prime BEEF Complex (Area C)
10. Establish USAFSAM Field Training Site - Alt 3/ Near Huffman Prairie (Area C)
11. Construct USAFSAM Pipeline Student Dorm – Kittyhawk Community Center

Current Planning Initiatives:

A. ASC Information Technology Center (ITC)
B. AAFES Commercial Dual-Food Facility
C. AFRL Materials Lab Campus
D. AFIT Campus
E. Privatized Family Housing
F. Dorm Master Plan Area
G. New SR 444 Corridor

88 ABW/CECX
COMMUNITY PLANNING
Bldg11/Rm109/Area C
WRIGHT-PATTERSON AFB

ADP UPDATE / PROJECT SITE APPROVAL:

✓ DRAFT Date	✓ DRAFT Date
88th Civil Engineer Director	**88th Air Base Wing Commander**

29-Mar-07

June 14, 2007

Raymond F. Baker
Cultural Resources Manager
Operations Branch
Environmental Management Division
88 ABW/CEVA, Bldg 89
5490 Pearson Road
Wright-Patterson Air Force Base, Ohio 45433-5332

Dear Mr. Baker:

Re: Base Realignment and Closure activities at Wright-Patterson Air Force Base

This is in response to correspondence received on April 16, 2007. My comments are made pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

Base Realignment and Closure (BRAC) activities throughout the Department of Defense will result in multiple mission activities relocating to Wright-Patterson Air Force Base (WPAFB). These activities will include (1) upgrading the Area B infrastructure to provide adequate site utilities, communications, and roadways and (2) the construction of approximately 700,000 square feet of new facilities, rehabilitation of approximately 300,000 square feet of existing facilities, and the evaluation of locations associated with support functions for the mission activities that will be relocating to the base.

WPAFB is in the process of preparing Environmental Assessments for each project. Early indications are that the proposed upgrade to Area B infrastructure will be largely limited to work along existing roadways. WPAFB is aware of the project's potential to affect WPAFB Mound (33GR31), which is listed in the National Register of Historic Places, and will take precautionary measures to ensure that the mound is not impacted by the infrastructure construction. Buildings 20012, 20017, and 20620 have been selected to house administrative and laboratory space associated with the incoming missions. WPAFB is aware that these three buildings have been determined to be eligible for listing in the National Register of Historic Places and intends to design the proposed work at the facilities to conform to the Secretary of the Interiors Standards for the Treatment of Historic Properties.

It is our understanding that WPAFB will provide copies of the completed Environmental Assessments and design documents to OHPO as they become available to facilitate Section 106 review. We will look forward to working with you throughout the consultation process established in 36 CFR Part 800.

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office
567 East Hudson Street, Columbus, Ohio 43211-1030 ph: 614.298.2000 fx: 614.298.2037
www.ohiohistory.org

If you have any questions, please contact me by phone at (614) 298-2000 or by e-mail at jcook@ohiohistory.org. Thank you for your cooperation.

Sincerely,

Justin M. Cook, History Reviews Manager
Resource Protection and Review

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 88TH AIR BASE WING (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

17 August 2007

88 ABW/CEVO, Bldg 89
5490 Pearson Road
Wright-Patterson AFB OH 45433-5332

Mr. Mark Epstein
Department Head, Resource Protection & Review
Ohio Historic Preservation Office
567 East Hudson Street
Columbus OH 43211-1030

Dear Mr. Epstein

This letter is a follow-up to our letter dated 13 Apr 07. Wright-Patterson Air Force Base (WPAFB) is currently preparing two Environmental Assessments (EA) to evaluate the environmental and cultural impacts of supporting multiple mission activities relocating to WPAFB as part of the Base Realignment and Closure (BRAC) 2005 decisions. We have decided to evaluate the impacts by assessing the infrastructure systems upgrades in one EA (titled Infrastructure EA), followed by assessing the impacts from the facility construction/renovation projects in the second EA (titled Facilities EA). The entire BRAC project includes eleven proposed project site locations as shown on the enclosed draft maps (Attachment 1).

The first EA which assesses the infrastructure upgrades in the Area B Hilltop area is in draft final form and is currently undergoing a 30 day public review period (8 Aug – 7 Sep 07). This EA evaluates a proposed action (Alternative 1) and two alternatives.

The second EA will evaluate plans to construct approximately 700,000 square feet of new facilities, renovate approximately 300,000 square feet of existing facilities, and evaluate locations associated with support functions for the multiple mission activities relocating to WPAFB from other bases around the nation. In Attachment 1, Map 1, site locations 2, 3, 5, 8, and 11 involve new building construction or additions to existing buildings on primarily open mowed fields/lawns. Site 4 is interior/exterior renovation of existing structures. Sites 9 and 10 (two alternative sites for one project) involve minor site improvements for mobile medical field training. Since our notification letter to you, project sites 6 and 7 on Map 1 have been removed from the project and projects 1 and 2 on Map 2 of Attachment 1 have been added. We are scheduled to receive the draft Facilities EA in Dec 07.

Our office understands that SHPO considers the entire BRAC effort as one undertaking, even though we have separated our assessment into two EAs. We acknowledge that in order for your office to make a determination of adverse affect or not, you need to consider both infrastructure and facility impacts as one undertaking. Consequently, we have included for your consultation the footprint of the proposed new facilities in the Area B Hilltop area which also are within the area of potential affect evaluated in the Infrastructure EA.

We have determined that no adverse effects to historic properties will occur by this undertaking as evaluated in the Infrastructure EA, in addition to the proposed new facility construction in the Hilltop area. In accordance with 36 CFR 800.11(d), we are submitting the following documentation.

Description of the undertaking assessed by the Infrastructure EA. The Proposed Action is to construct new infrastructure and upgrade and/or replace existing infrastructure systems in the Area B Hilltop District of WPAFB to prepare the area for future facilities associated with inbound BRAC missions. The location of the infrastructure upgrades must be in close proximity to the new facilities that would be constructed. Infrastructure systems to be upgraded include roadways; electrical power; communications; steam and water distribution systems; and sanitary and storm sewers. Activities associated with the infrastructure upgrades would include demolition of Facilities 20430 and 20682, site preparation, road construction, trenching, re-grading, and landscaping. Minimal site preparation activities (for example, clearing and grubbing) are anticipated in portions of the project area which are located primarily in open lawn. Extensive site preparation activities are anticipated in the location of the proposed new entrance/gate. Because the exact location of the facilities associated with the inbound BRAC missions has not been finalized, the portion of the utilities that tie into each building will not be completed until the facilities are under construction. Existing and/or new utilities would be routed out of the way of the new buildings. It is proposed that utilities will be installed below grade approximately 5 to 6 feet.

Under Alternative 2, the No Action Alternative, it is assumed that infrastructure upgrades would not be completed. This alternative serves as a baseline against which the Proposed Action can be compared.

Under Alternative 3, the infrastructure upgrades would be phased to coordinate with the construction of each facility associated with the inbound BRAC missions instead of as a single overall effort. Each component listed under the Proposed Action would be included in this alternative. This alternative could potentially increase the cost and length of time to complete the infrastructure upgrades by segmenting the project.

The area of potential effects (APE) for the Proposed Action and Alternative 3 is identified in Figure 13 (Attachment 2) by two red outlined project areas. The larger project area borders the eastern edge of the Wright Field Historic District (also a historic cultural landscape) and encompasses the WPAFB Mound (33 GR 31) and includes infrastructure system (utility and road) upgrades, site preparation, road construction, closing of Gate 19B, creating a new gate off National Road, and two building demolitions. The smaller project area is located within the Wright Field Historic District and involves two proposed wastewater system upgrades to existing sanitary lines along F and G Streets. Figures 3 and 5 through 10 in Attachment 2 are detailed maps of the proposed individual infrastructure system upgrades. There is no APE for Alternative 2 because no activity would occur under this action.

Description of the new Hilltop Facility Construction undertaking . WPAFB proposes to construct approximately 700,000 square feet of new facilities in the Hilltop area both on the north and south sides of Fifth Street. North and south parking lots will be required for their respective buildings, with the central lot to the east supplying the remaining population a location that can serve both buildings simultaneously. The proposed architecture in the 35% design submittal for the new facilities will be a maximum of three stories with precast brick and glass banding to crisp precast volumes on a base of brick, against the background of a glass circulation spine. It is anticipated that the building foundations for the new facilities in the Hilltop area will range from 8 to 13 feet below grade. Attachment 3 contains

35% design conceptual building layout, elevations and aerial views. The APE for the new Hilltop facilities construction is the same larger project area as identified above for the infrastructure Proposed Action (Attachment 2, Figure 13).

Description of steps taken to identify historic properties. WPAFB has assessed all buildings on the installation that are 50 years old or older, and has assessed buildings for exceptional significance relating to the Cold War. Your office has reviewed the information we have collected, and our two offices have reached a consensus determination of eligibility for listing on the National Register of Historic Places (NRHP) for facilities at WPAFB. We have also undertaken archeological surveys for prehistoric and historic-era archaeological sites, and have provided reports of those surveys to your office for review.

The smaller project area is located within the Wright Field Historic District and involves two proposed wastewater system upgrades to existing sanitary lines along F and G Streets (Attachment 2, Figure 7). Approximately 350 feet and 525 feet of sanitary lines along F and G Streets, respectively, will be removed and upgraded with new lines in the existing locations. Since the new lines will be installed in the existing sanitary trenches there will be no impacts to the surrounding historic buildings nor is it likely that any archaeological resources would be discovered or impacted since it is an existing disturbed area.

The larger project area borders the eastern edge of the Wright Field Historic District and includes the new Hilltop facility construction, infrastructure system (utility and road) upgrades, site preparation, road construction, closing of Gate 19B, creating a new gate off National Road, and demolition of Facilities 20430 and 20682. Buildings 430 and 682 in Area B, have been evaluated and determined ineligible for NRHP listing and are not part of any historic landscape or district. See Attachment 4 for OHI forms.

In 1990, the U.S. Army Construction Engineering Research Laboratory (USACERL) conducted a prehistoric survey covering 400 acres located in the Hilltop area. The following three prehistoric archaeological sites were discovered: 33 GR 796, 33 GR 797, 33 GR 798 (see Attachment 2, Figure 13 for location within the APE). In August 2002 Hardlines Design Company conducted Phase II testing of these three sites and WPAFB concluded, with SHPO concurrence, that the three sites were not eligible for the NRHP. In October-December 2001, Gray & Pape, Inc. conducted Phase I investigations at WPAFB as a part of the base's ongoing Section 110 responsibilities for identifying and protecting historic properties on its land. The project was focused on identifying potential prehistoric resources located in areas previously identified as having a low to moderate probability for containing prehistoric sites. An area between National Road and Q Street was surveyed and Site 33 GR 1171 was discovered, but it lacked research potential because of its light density of cultural remains (see Attachment2, Figure 13 for location within the APE). WPAFB determined the site to be ineligible for the NRHP and SHPO concurred in a letter dated 5 Apr 02.

The only known NRHP listed archaeological resource located within the APE is the WPAFB Mound, Site 33 GR 31, which is located at the corner of Hobson Way and Seventh Street (see Attachment 2, Figure 13). The only infrastructure upgrade that may have a potential to impact the mound is the installation of a new water line along the west side of Hobson Way (see Attachment 2, Figure 6). The proposed construction will approach no closer than 50 feet from the mound; therefore, no impacts to this resource are expected.

Basis for determining no historic properties adversely affected. The cultural resources assessment in the Infrastructure EA is described in Sections 3.7 and 4.7 of the attached excerpt from the draft EA

(Attachment 5). Should inadvertent discoveries of cultural resources occur during ground-disturbing activities, the work will immediately cease and the base Cultural Resources Manager (CRM) will be notified. The procedures for inadvertent discoveries outlined in Section D.2.4 in our Integrated Cultural Resources Management Plan, May 2006, which include SHPO notification, will be followed. In addition the construction contractor will be made aware of WPAFB procedures prior to the start of any construction activities. The following protective measures will be followed to ensure the WPAFB Mound will not be impacted by construction activities:

1. Prior to the start of any work, the CRM will conduct a site visit at the mound with the construction contractor to identify its location.
2. Prior to the start of any work, the CRM will install stakes and caution tape with a buffer zone of 40 feet around the mound to notify workers not to cross the tape.
3. Once construction work begins, the CRM will conduct weekly inspections at the mound to ensure work does not encroach upon the buffer zone or the mound.

Based upon our past archaeological surveys, historic building evaluations, and protective measures for the WPAFB Mound, we have determined that no historic properties will be adversely impacted within the two project areas. Therefore, this undertaking, which includes both the infrastructure systems upgrades and the new Hilltop facility construction, will not adversely affect historic or cultural resources at WPAFB.

Please review the documentation we have provided and let us know whether you concur with our assessment. Should you have questions, I can be reached at (937) 257-0177, or via email at raymond.baker@wpafb.af.mil.

Sincerely

Raymond F. Baker

RAYMOND F. BAKER
Cultural Resources Program Manager
Operations Branch
Environmental Management Division

Attachments
1. BRAC Project Site Maps
2. Figures
3. 35% Design Building Concepts
4. Facility 20430 and 20682 OHI Forms
5. Excerpts from Draft Infrastructure EA

September 5, 2007

Raymond F. Baker
Cultural Resources Program Manager
Operations Branch
Environmental Management Division
88 ABW/CEVO, Building 89
5490 Pearson Road
Wright-Patterson Air Force Base, Ohio 45433-5332

Dear Mr. Baker:

Re: Hilltop Facility construction and proposed wastewater systems upgrades along F and G Streets, Area B, Wright-Patterson Air Force Base, Ohio

This is in response to correspondence received on August 20, 2007. My comments are made pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

As part of a series of projects related to Base Realignment and Closure (BRAC) activities throughout the Department of Defense, Wright-Patterson Air Force Base (WPAFB) proposes to complete site preparation work in the Hilltop region in Area B of the base to facilitate the construction of approximately 700,000 square feet of new facilities. Work will include utility and road upgrades, road and parking lot construction, the closing of Gate 19B and creation of a new gate off National Road, site grading, and demolition of Facilities 20430 and 20682.

Following the completion of site preparation, several new buildings will be constructed throughout the base. The only construction project for which preliminary design information is currently available is the new Human Performance Wing (HPW) facility in the Hilltop region of Area B. A new building will be constructed on both the north and south sides of Fifth Street between Hobson Way and Q Street to house the HPW. These two buildings will be a maximum of three stories tall, feature steel frame construction with precast brick and glass curtain wall exteriors, and utilize glass circulation spines.

In addition to work to be completed in the Hilltop region, WPAFB proposes to complete upgrades to approximately 350 feet of sanitary sewer lines along F Street and approximately 525 feet of sanitary sewer lines along G Street in Area B of the base. Work will be limited to installing new lines in existing trenches.

Based on available archaeology and history/architecture survey data, information provided in your submission dated August 17, 2007, and observations made during our July 17, 2007 site visit to WPAFB, we concur with your finding that the proposed work will have no adverse effect on historic properties provided that the following conditions are met:

1. Prior to the start of any work, the base Cultural Resources Manager (CRM) will conduct a site visit at WPAFB Mound with the construction contractor to identify its location.
2. Prior to the start of any work, the CRM will install stakes and caution tape with a buffer zone of 40 feet around WPAFB Mound to notify workers not to cross the tape.
3. Once construction work begins, the CRM will conduct weekly inspections at WPAFB Mound to ensure work does not encroach upon the buffer zone or the mound.
4. Following the completion of site preparation work but prior to the start of construction activities, WPAFB will submit site plans and elevation drawings for all new buildings to be constructed as part of the BRAC activities at the base to the Ohio Historic Preservation Office for review and comment. OHPO will provide comments regarding the plans' conformance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* as they apply to new construction adjacent to historic properties. If OHPO feels that a proposed construction activity has the potential to violate relevant Standards, WPAFB will reinitiate Section 106 consultation following the process outlined in 36 CFR Section 800.6.

   No additional information regarding the proposed Human Performance Wing facility is needed because sufficient documentation was included in your submission for us to concur with your finding that the construction of this facility will conform to the Standards and have no adverse effect on historic properties.

5. Prior to the commencement of BRAC-related construction activity associated with the rehabilitation of buildings that have been determined to be eligible for listing in the National Register of Historic Places, WPAFB will submit plans, specifications, and photographs of the affected areas of the buildings to OHPO for review and comment. OHPO will provide comments regarding the plans' conformance with the *Secretary of the Interior's Standards for Rehabilitation*. If OHPO feels that a proposed rehabilitation activity has the potential to violate the Standards, WPAFB will reinitiate Section 106 consultation following the process outlined in 36 CFR Section 800.6.

We look forward to working with you as BRAC-related construction projects are developed in more detail. If you have any questions, please contact Justin Cook, History Reviews Manager, by phone at (614) 298-2000 or by email at jcook@ohiohistory.org. Thank you for your cooperation.

Sincerely,

Mark J. Epstein, Department Head
Resource Protection and Review

MJE:jc

1014850

Appendix F
Air Emissions Calculations

Infrastructure Upgrades and Construction of HPW Complex
Fugitive Dust Emissions Estimate - Worst-Case Scenario

Construction Emissions

Area Description	Area		Project Duration	Emission Factor	Control Efficiency	Estimated Emissions
	A		T	EM_{FAC}	CE	E_{TON}
	A = L * W			†1	†2	$E_{TON} = A * T * EM_{FAC}$
	($ft.^2$)	(acre)	(months)	(ton/acre/month)	(%)	(ton)
Building 1 Demolition	7,200.0	0.2	3.00	1.2	80%	0.12
Gate/Roadway Construction	392,040.0	9.0	3.00	1.2	80%	6.48
South Area (Bldg, utilities, parking lot, demolition)	950,400.0	21.8	12.00	1.2	80%	62.85
North Area (Bldg, utilities, parking lot)	633,600.0	14.5	12.00	1.2	80%	41.9
Detention Basin	115,200.0	2.6	12.00	1.2	80%	7.62
Roadway Improvements	100,000.0	2.3	12.00	1.2	80%	6.61
CONSTRUCTION IMPACT	2,198,440.0	50.5				125.57

Normal Base-wide Emissions	*Variable Description*
E_{NORM}	*Symbol*
†3	*Footnote*
(ton/yr.)	*Units*
19.68	*Values*

Conclusions:
Project likely to exceed de minums 5 TPY particulate threshold.

LEGEND

†1 Note: Emission factor Section 13.2.3 "Heavy Construction Operations" (dated 1/95), of AP-42, "Compilation of Air Pollutant Emission Factors", 5th Edition, U.S. EPA, Research Triangle Park, NC, 1998.

†2 Note: Table 2.1.1-3 - "Summary of Techniques, Efficiencies, and Costs for Controlling Fugitive Dust from Paved and Unpaved Surfaces," Fugitive Dust Control Technology, Orlemann (1993).

Control efficiency for watering of paved surfaces.

†3 Note: Particulate emissions from WPAFB Fee Emission Report for 2005.

Infrastructure Upgrades and Construction of HPW Complex
Fugitive Dust Emissions Estimate - Reasonably Anticipated Scenario

Construction Emissions

Area Description	Area		Project Duration	Emission Factor	Control Efficiency	Estimated Emissions
	A		T	EM_{FAC}	CE	E_{TON}
	A = L * W			†2	†3	$E_{TON} = A * T * EM_{FAC}$
	($ft.^2$)	(acre)	(months)	(ton/acre/month)	(%)	(ton)
Building 1 Demolition	7,200.0	0.0	6.00	1.2	80%	0.05
Gate/Roadway Construction	392,040.0	1.8	6.00	1.2	80%	2.59
CONSTRUCTION IMPACT	399,240.0	1.8				2.64
South Area (Bldg, utilities, parking lot, demolition) †1	950,400.0	4.4	6.00	1.2	80%	6.28
North Area (Bldg, utilities, parking lot) †1	633,600.0	2.9	6.00	1.2	80%	4.19
Detention Basin †1	115,200.0	0.5	6.00	1.2	80%	0.76
Roadway Improvements †1	100,000.0	0.5	6.00	1.2	80%	0.66
CONSTRUCTION IMPACT	1,799,200.0	8.3				11.9

Normal Base-wide Emissions	*Variable Description*
E_{NORM}	*Symbol*
†4	*Footnote*
(ton/yr.)	*Units*
19.68	*Values*

Conclusions:
Project likely to exceed de minums 5 TPY particulate threshold.

LEGEND

†1 Note: Assumes 20% of project area is exposed for a period of 6 months.

†2 Note: Emission factor Section 13.2.3 "Heavy Construction Operations" (dated 1/95), of AP-42, "Compilation of Air Pollutant Emission Factors", 5th Edition, U.S. EPA, Research Triangle Park, NC, 1998.

†3 Note: Table 2.1.1-3 - "Summary of Techniques, Efficiencies, and Costs for Controlling Fugitive Dust from Paved and Unpaved Surfaces," Fugitive Dust Control Technology, Orlemann (1993).
Control efficiency for watering of paved surfaces.

†4 Note: Particulate emissions from WPAFB Fee Emission Report for 2005.

Appendix F

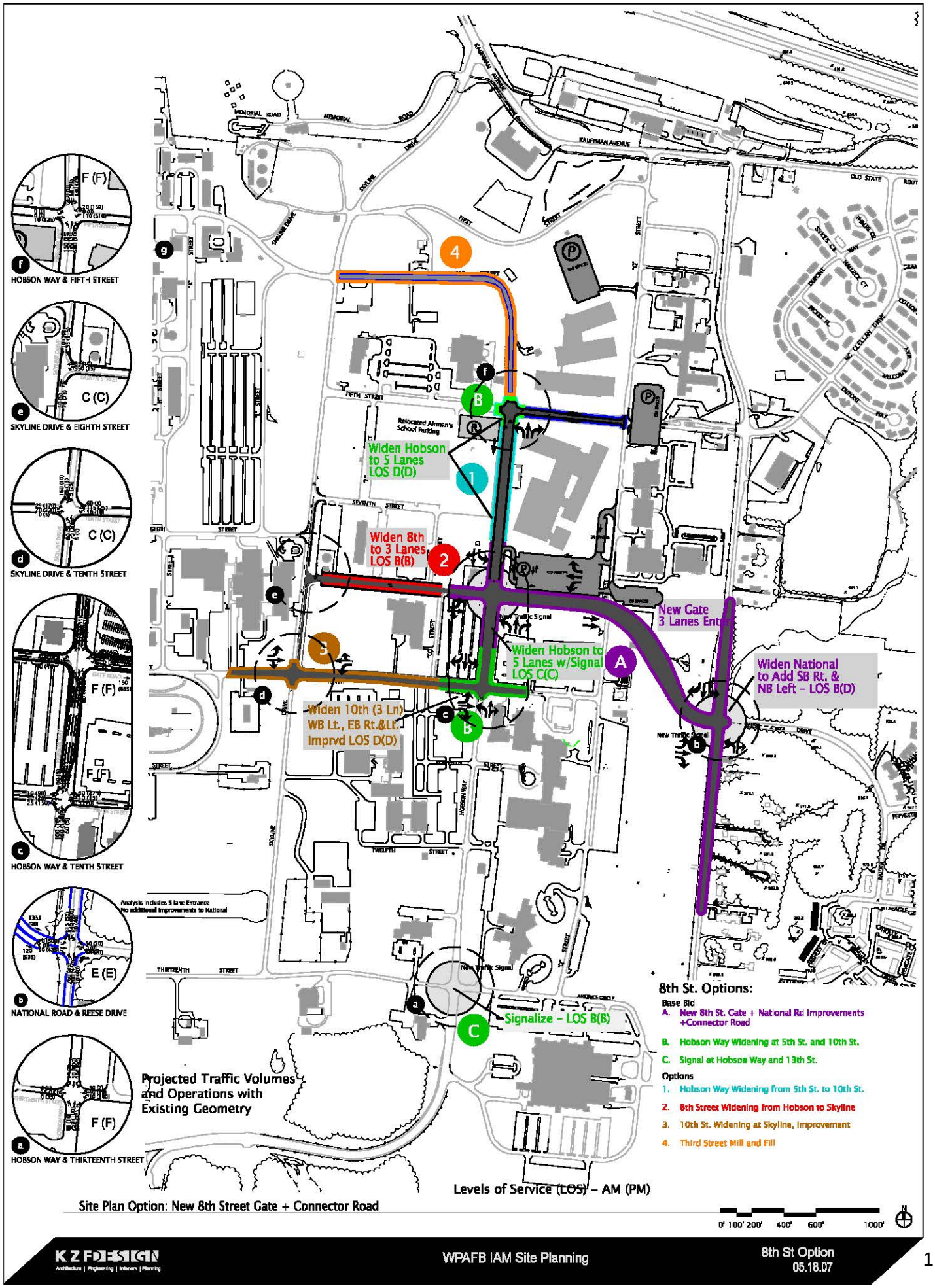
Estimated Increase in Air Emissions from Heating Plant 20770 due to Construction of HPW Complex

The emissions estimates are calculated by taking the actual 2006 emissions and increasing them by 34.2%, accounting for the calculated 60,000 lbs steam/hr increase attributed to HPW Complex.

Pollutant	2006 Actual Emissions	Emissions increase: Tons/yr	Total Emissions: Tons/yr	Title V Permit Limit
NMTOC*	0.77	0.26	1.03	N/A
PM	2.11	0.72	2.83	56.78
Condensible PM	16.72	5.73	22.45	N/A
NOx	168.42	57.74	226.16	336.54
SO2	622.88	213.53	836.41	1135.68
CO	76.56	26.24	102.8	105.17
Pb	0.01	none	0.01	N/A
NH3	0.01	none	0.01	N/A

* Non methane total organic compounds

Appendix G
Traffic Calculations



KZ DESIGN
Architecture | Engineering | Interiors | Planning

WPAFB IAM Site Planning

8th St Option
05.18.07

Existing Conditions Capacity Analysis

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst		Intersection	1 - Gate 1B & 5th
Agency or Co.	KZF Design	Area Type	All other areas
Date Performed	11/1/2006	Jurisdiction	WPAFB
Time Period	AM Peak	Analysis Year	
		Project ID	COE JV-WPAFB IAM Infrastructure RFP

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	1	1	1	1	0	2	1	0
Lane Group	L	TR		L	T	R	L	TR		L	TR	
Volume, V (vph)	19	191	0	15	83	193	1	52	9	494	367	48
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3	3	3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 7.0	G = 18.0	G =	G =	G = 7.0	G = 15.0	G = 20.0	G =
	Y = 4	Y = 5	Y =	Y =	Y = 4	Y = 5	Y = 5	Y =
Duration of Analysis, T = 0.25					Cycle Length, C = 90.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	21	212		17	92	214	1	68		549	461	
Lane Group Capacity, c	407	724		366	380	879	140	413		1013	830	
v/c Ratio, X	0.05	0.29		0.05	0.24	0.24	0.01	0.16		0.54	0.56	
Total Green Ratio, g/C	0.32	0.20		0.32	0.20	0.54	0.08	0.22		0.29	0.44	
Uniform Delay, d_1	21.0	30.6		21.0	30.3	10.8	38.3	28.3		27.0	18.4	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.11		0.11	0.11	0.11	0.11	0.11		0.14	0.15	
Incremental Delay, d_2	0.1	0.2		0.1	0.3	0.1	0.0	0.2		0.6	0.8	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay	21.1	30.8		21.0	30.6	10.9	38.3	28.4		27.6	19.3	
Lane Group LOS	C	C		C	C	B	D	C		C	B	
Approach Delay	29.9			17.1			28.6			23.8		
Approach LOS	C			B			C			C		
Intersection Delay	23.5			X_C = 0.40			Intersection LOS			C		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst		Intersection	*1 - Gate 1B & 5th*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*2*	*0*	*1*	*1*	*1*	*1*	*1*	*0*	*2*	*1*	*0*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*TR*		*L*	*TR*	
Volume, V (vph)	*61*	*4*	*1*	*4*	*220*	*404*	*10*	*306*	*10*	*51*	*61*	*17*
% Heavy Vehicles, %HV	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green, e	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*		*3*	*3*	
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Initial Unmet Demand, Q_b	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	Excl. Left	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = *7.0*	G = *20.0*	G =	G =	G = *12.0*	G = *32.0*	G =	G =
	Y = *4*	Y = *5*	Y =	Y =	Y = *5*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *90.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*68*	*5*		*4*	*244*	*449*	*11*	*351*		*57*	*87*	
Lane Group Capacity, c	*307*	*780*		*521*	*422*	*664*	*241*	*672*		*467*	*654*	
v/c Ratio, X	*0.22*	*0.01*		*0.01*	*0.58*	*0.68*	*0.05*	*0.52*		*0.12*	*0.13*	
Total Green Ratio, g/C	*0.34*	*0.22*		*0.34*	*0.22*	*0.41*	*0.13*	*0.36*		*0.13*	*0.36*	
Uniform Delay, d_1	*20.8*	*27.3*		*19.4*	*31.2*	*21.6*	*34.0*	*23.0*		*34.4*	*19.6*	
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*	*0.11*		*0.11*	*0.17*	*0.25*	*0.11*	*0.13*		*0.11*	*0.11*	
Incremental Delay, d_2	*0.4*	*0.0*		*0.0*	*2.0*	*2.7*	*0.1*	*0.7*		*0.1*	*0.1*	
Initial Queue Delay, d_3	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Control Delay	*21.2*	*27.3*		*19.4*	*33.2*	*24.4*	*34.1*	*23.7*		*34.5*	*19.7*	
Lane Group LOS	*C*	*C*		*B*	*C*	*C*	*C*	*C*		*C*	*B*	
Approach Delay	*21.6*			*27.4*			*24.0*			*25.6*		
Approach LOS	*C*			*C*			*C*			*C*		
Intersection Delay	*25.9*			X_C = *0.60*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information	***Site Information***	
Analyst	Intersection	*1 - 5th and B*
Agency or Co. *KZF Design*	Area Type	*All other areas*
Date Performed *11/1/2006*	Jurisdiction	*WPAFB*
Time Period AM Peak	Analysis Year	
	Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*2*			*2*					*1*		*2*
Lane Group		*T*			*T*					*L*		*R*
Volume, V (vph)		*537*			*50*					*23*		*26*
% Heavy Vehicles, %HV		*0*			*0*					*0*		*0*
Peak-Hour Factor, PHF		*0.90*			*0.90*					*0.90*		*0.90*
Pretimed (P) or Actuated (A)		*A*			*A*					*A*		*A*
Start-up Lost Time, l_1		*2.0*			*2.0*					*2.0*		*2.0*
Extension of Effective Green, e		*2.0*			*2.0*					*2.0*		*2.0*
Arrival Type, AT		*3*			*3*					*3*		*3*
Unit Extension, UE		*3.0*			*3.0*					*3.0*		*3.0*
Filtering/Metering, I		*1.000*			*1.000*					*1.000*		*1.000*
Initial Unmet Demand, Q_b		*0.0*			*0.0*					*0.0*		*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*					*0*	*0*	*0*
Lane Width		*12.0*			*12.0*					*12.0*		*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*				*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*			*0*					*0*		*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*						*15.7*		

Phasing	Thru Only	02	03	04	SB Only	06	07	08
Timing	G = *25.0*	G =	G =	G =	G = *25.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =

Duration of Analysis, T = *0.25* | Cycle Length, C = *60.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*597*			*56*					*26*		*29*
Lane Group Capacity, c		*1507*			*1507*					*752*		*1191*
v/c Ratio, X		*0.40*			*0.04*					*0.03*		*0.02*
Total Green Ratio, g/C		*0.42*			*0.42*					*0.42*		*0.42*
Uniform Delay, d_1		*12.2*			*10.4*					*10.4*		*10.3*
Progression Factor, PF		*1.000*			*1.000*					*1.000*		*1.000*
Delay Calibration, k		*0.11*			*0.11*					*0.11*		*0.11*
Incremental Delay, d_2		*0.2*			*0.0*					*0.0*		*0.0*
Initial Queue Delay, d_3		*0.0*			*0.0*					*0.0*		*0.0*
Control Delay		*12.4*			*10.4*					*10.4*		*10.3*
Lane Group LOS		*B*			*B*					*B*		*B*
Approach Delay	*12.4*			*10.4*						*10.3*		
Approach LOS	*B*			*B*						*B*		
Intersection Delay	*12.1*			X_C = *0.22*			Intersection LOS			*B*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*1 - 5th and B*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*2*			*2*					*1*		*2*
Lane Group		*T*			*T*					*L*		*R*
Volume, V (vph)		*72*			*352*					*16*		*199*
% Heavy Vehicles, %HV		*0*			*0*					*0*		*0*
Peak-Hour Factor, PHF		*0.90*			*0.90*					*0.90*		*0.90*
Pretimed (P) or Actuated (A)		*A*			*A*					*A*		*A*
Start-up Lost Time, l_1		*2.0*			*2.0*					*2.0*		*2.0*
Extension of Effective Green, e		*2.0*			*2.0*					*2.0*		*2.0*
Arrival Type, AT		*3*			*3*					*3*		*3*
Unit Extension, UE		*3.0*			*3.0*					*3.0*		*3.0*
Filtering/Metering, I		*1.000*			*1.000*					*1.000*		*1.000*
Initial Unmet Demand, Q_b		*0.0*			*0.0*					*0.0*		*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*					*0*	*0*	*0*
Lane Width		*12.0*			*12.0*					*12.0*		*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*				*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*			*0*					*0*		*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*						*15.7*		

Phasing	Thru Only	02	03	04	SB Only	06	07	08
Timing	G = *20.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =

Duration of Analysis, T = *0.25* | Cycle Length, C = *60.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*80*			*391*					*18*		*221*
Lane Group Capacity, c		*1206*			*1206*					*903*		*1430*
v/c Ratio, X		*0.07*			*0.32*					*0.02*		*0.15*
Total Green Ratio, g/C		*0.33*			*0.33*					*0.50*		*0.50*
Uniform Delay, d_1		*13.6*			*14.9*					*7.6*		*8.1*
Progression Factor, PF		*1.000*			*1.000*					*1.000*		*1.000*
Delay Calibration, k		*0.11*			*0.11*					*0.11*		*0.11*
Incremental Delay, d_2		*0.0*			*0.2*					*0.0*		*0.1*
Initial Queue Delay, d_3		*0.0*			*0.0*					*0.0*		*0.0*
Control Delay		*13.7*			*15.1*					*7.6*		*8.2*
Lane Group LOS		*B*			*B*					*A*		*A*
Approach Delay	*13.7*			*15.1*						*8.1*		
Approach LOS	*B*			*B*						*A*		
Intersection Delay	*12.6*			X_C = *0.22*			Intersection LOS			*B*		

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	
Agency/Co.	
Date Performed	
Analysis Time Period	

Site Information

Intersection	
Jurisdiction	
Analysis Year	

Project ID

East/West Street: North/South Street:

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)						
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)						
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration								
PHF								
Flow Rate (veh/h)								
% Heavy Vehicles								
No. Lanes								
Geometry Group								
Duration, T								

Saturation Headway Adjustment Worksheet

Prop. Left-Turns								
Prop. Right-Turns								
Prop. Heavy Vehicle								
hLT-adj								
hRT-adj								
hHV-adj								
hadj, computed								

Departure Headway and Service Time

hd, initial value (s)								
x, initial								
hd, final value (s)								
x, final value								
Move-up time, m (s)								
Service Time, t_s (s)								

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)								
Delay (s/veh)								
LOS								
Approach: Delay (s/veh)								
LOS								
Intersection Delay (s/veh)								
Intersection LOS								

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	
Agency/Co.	
Date Performed	
Analysis Time Period	

Site Information

Intersection	
Jurisdiction	
Analysis Year	

Project ID

East/West Street: North/South Street:

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)						
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)						
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration								
PHF								
Flow Rate (veh/h)								
% Heavy Vehicles								
No. Lanes								
Geometry Group								
Duration, T								

Saturation Headway Adjustment Worksheet

Prop. Left-Turns								
Prop. Right-Turns								
Prop. Heavy Vehicle								
hLT-adj								
hRT-adj								
hHV-adj								
hadj, computed								

Departure Headway and Service Time

hd, initial value (s)								
x, initial								
hd, final value (s)								
x, final value								
Move-up time, m (s)								
Service Time, t_s (s)								

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)								
Delay (s/veh)								
LOS								
Approach: Delay (s/veh)								
LOS								
Intersection Delay (s/veh)								
Intersection LOS								

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/27/2007*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*5 - 3rd & K St.*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *3rd St.* North/South Street: *K St.*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*10*	*45*	*5*	*5*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*5*	*0*	*66*	*238*	*38*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*5*	*0*	*60*	*215*	*35*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*5*	*5*	*5*	*11*	*50*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*5*	*5*		*342*			*10*	
C (m) (veh/h)	*1597*	*1530*		*853*			*655*	
v/c	*0.00*	*0.00*		*0.40*			*0.02*	
95% queue length	*0.01*	*0.01*		*1.95*			*0.05*	
Control Delay (s/veh)	*7.3*	*7.4*		*12.0*			*10.6*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*12.0*			*10.6*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/27/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*5 - 3rd & K St.*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *3rd St.* North/South Street: *K St.*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*40*	*15*	*5*	*25*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*194*	*5*	*16*	*16*	*0*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*175*	*5*	*15*	*15*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*16*	*5*	*27*	*5*	*0*	*44*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*5*	*16*		*32*			*199*	
C (m) (veh/h)	*1567*	*1552*		*687*			*776*	
v/c	*0.00*	*0.01*		*0.05*			*0.26*	
95% queue length	*0.01*	*0.03*		*0.15*			*1.02*	
Control Delay (s/veh)	*7.3*	*7.3*		*10.5*			*11.2*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*10.5*			*11.2*		
Approach LOS	--	--	*B*			*B*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*6 - 3rd & Skyline*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	AM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*1*
Lane Group		*LT*	*R*		*LTR*			*LTR*			*LT*	*R*
Volume, V (vph)	*2*	*8*	*5*	*279*	*0*	*1*	*5*	*5*	*39*	*0*	*34*	*0*
% Heavy Vehicles, %HV	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*			*2.0*			*2.0*	*2.0*
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*			*2.0*			*2.0*	*2.0*
Arrival Type, AT		*3*	*3*		*3*			*3*			*3*	*3*
Unit Extension, UE		*3.0*	*3.0*		*3.0*			*3.0*			*3.0*	*3.0*
Filtering/Metering, I		*1.000*	*1.000*		*1.000*			*1.000*			*1.000*	*1.000*
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*			*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*			*12.0*			*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*			*0*			*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *20.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*11*	*6*		*311*			*55*			*38*	*0*
Lane Group Capacity, c		*915*	*808*		*683*			*556*			*633*	*538*
v/c Ratio, X		*0.01*	*0.01*		*0.46*			*0.10*			*0.06*	*0.00*
Total Green Ratio, g/C		*0.50*	*0.50*		*0.50*			*0.33*			*0.33*	*0.33*
Uniform Delay, d_1		*7.5*	*7.5*		*9.7*			*13.8*			*13.6*	*13.3*
Progression Factor, PF		*1.000*	*1.000*		*1.000*			*1.000*			*1.000*	*1.000*
Delay Calibration, k		*0.11*	*0.11*		*0.11*			*0.11*			*0.11*	*0.11*
Incremental Delay, d_2		*0.0*	*0.0*		*0.5*			*0.1*			*0.0*	*0.0*
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*			*0.0*			*0.0*	*0.0*
Control Delay		*7.6*	*7.5*		*10.2*			*13.9*			*13.6*	*13.3*
Lane Group LOS		*A*	*A*		*B*			*B*			*B*	*B*
Approach Delay	*7.5*			*10.2*			*13.9*			*13.6*		
Approach LOS	*A*			*B*			*B*			*B*		
Intersection Delay	*10.9*			X_C = *0.31*			Intersection LOS			*B*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst		Intersection	*6 - 3rd & Skyline*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*1*
Lane Group		*LT*	*R*		*LTR*			*LTR*			*LT*	*R*
Volume, V (vph)	*0*	*1*	*0*	*25*	*0*	*3*	*0*	*8*	*224*	*0*	*2*	*0*
% Heavy Vehicles, %HV	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*			*2.0*			*2.0*	*2.0*
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*			*2.0*			*2.0*	*2.0*
Arrival Type, AT		*3*	*3*		*3*			*3*			*3*	*3*
Unit Extension, UE		*3.0*	*3.0*		*3.0*			*3.0*			*3.0*	*3.0*
Filtering/Metering, I		*1.000*	*1.000*		*1.000*			*1.000*			*1.000*	*1.000*
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*			*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*			*12.0*			*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*			*0*			*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *14.0*	G =	G =	G =	G = *7.0*	G = *25.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *4*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*1*	*0*		*31*			*258*			*2*	*0*
Lane Group Capacity, c		*443*	*377*		*354*			*688*			*872*	*969*
v/c Ratio, X		*0.00*	*0.00*		*0.09*			*0.38*			*0.00*	*0.00*
Total Green Ratio, g/C		*0.23*	*0.23*		*0.23*			*0.42*			*0.60*	*0.60*
Uniform Delay, d_1		*17.6*	*17.6*		*18.0*			*12.1*			*4.8*	*4.8*
Progression Factor, PF		*1.000*	*1.000*		*1.000*			*1.000*			*1.000*	*1.000*
Delay Calibration, k		*0.11*	*0.11*		*0.11*			*0.11*			*0.11*	*0.11*
Incremental Delay, d_2		*0.0*	*0.0*		*0.1*			*0.3*			*0.0*	*0.0*
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*			*0.0*			*0.0*	*0.0*
Control Delay		*17.6*	*17.6*		*18.1*			*12.4*			*4.8*	*4.8*
Lane Group LOS		*B*	*B*		*B*			*B*			*A*	*A*
Approach Delay	*17.6*			*18.1*			*12.4*			*4.8*		
Approach LOS	*B*			*B*			*B*			*A*		
Intersection Delay	*13.0*			X_C = *0.24*			Intersection LOS			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	
Agency/Co.	*KZF Design*
Date Performed	*11/2/2006*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*5th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *Fifth St.* North/South Street: *Hobson*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*0*	*42*	*2*	*190*	*444*	*15*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*46*	*2*	*211*	*493*	*16*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*46*	*6*	*23*	*3*	*4*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*51*	*6*	*25*	*3*	*4*	*0*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*0*
Configuration	*L*		*TR*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*L*		*TR*		*LTR*	
v (veh/h)	*0*	*211*	*51*		*31*		*7*	
C (m) (veh/h)	*1038*	*1543*	*276*		*592*		*198*	
v/c	*0.00*	*0.14*	*0.18*		*0.05*		*0.04*	
95% queue length	*0.00*	*0.47*	*0.66*		*0.17*		*0.11*	
Control Delay (s/veh)	*8.5*	*7.7*	*21.0*		*11.4*		*23.8*	
LOS	*A*	*A*	*C*		*B*		*C*	
Approach Delay (s/veh)	--	--	*17.4*			*23.8*		
Approach LOS	--	--	*C*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*11/2/2006*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*5th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *Fifth St.* North/South Street: *Hobson*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*0*	*340*	*74*	*19*	*16*	*1*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*377*	*82*	*21*	*17*	*1*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*9*	*0*	*119*	*13*	*4*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*132*	*14*	*4*	*0*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*0*
Configuration	*L*		*TR*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LT*	*L*		*TR*		*LTR*	
v (veh/h)	*0*	*21*	*10*		*132*		*18*	
C (m) (veh/h)	*1583*	*1084*	*462*		*766*		*526*	
v/c	*0.00*	*0.02*	*0.02*		*0.17*		*0.03*	
95% queue length	*0.00*	*0.06*	*0.07*		*0.62*		*0.11*	
Control Delay (s/veh)	*7.3*	*8.4*	*13.0*		*10.7*		*12.1*	
LOS	*A*	*A*	*B*		*B*		*B*	
Approach Delay (s/veh)	--	--	*10.8*			*12.1*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*9 - 5th & Q St.*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/27/2007*	Analysis Year	*Ex. 2006*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *5th St.* North/South Street: *Q St.*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*10*	*40*	*15*	*5*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*11*	*55*	*11*	*266*	*722*	*27*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*50*	*10*	*240*	*650*	*25*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*16*	*5*	*0*	*5*	*11*	*44*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*	*LT*		*TR*	*LT*		*TR*
v (veh/h)	*5*	*16*	*627*		*388*	*38*		*38*
C (m) (veh/h)	*1603*	*1537*	*796*		*808*	*272*		*841*
v/c	*0.00*	*0.01*	*0.79*		*0.48*	*0.14*		*0.05*
95% queue length	*0.01*	*0.03*	*8.06*		*2.64*	*0.48*		*0.14*
Control Delay (s/veh)	*7.3*	*7.4*	*24.1*		*13.5*	*20.4*		*9.5*
LOS	*A*	*A*	*C*		*B*	*C*		*A*
Approach Delay (s/veh)	--	--	*20.0*			*14.9*		
Approach LOS	--	--	*C*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/27/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*9 - 5th & Q St.*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *5th St.* North/South Street: *Q St.*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*250*	*10*	*0*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*522*	*5*	*5*	*38*	*5*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*470*	*5*	*5*	*35*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*11*	*0*	*0*	*5*	*0*	*277*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*	*LT*		*TR*	*LT*		*TR*
v (veh/h)	*5*	*11*	*24*		*24*	*261*		*266*
C (m) (veh/h)	*1610*	*1274*	*370*		*743*	*595*		*600*
v/c	*0.00*	*0.01*	*0.06*		*0.03*	*0.44*		*0.44*
95% queue length	*0.01*	*0.03*	*0.21*		*0.10*	*2.23*		*2.27*
Control Delay (s/veh)	*7.2*	*7.9*	*15.4*		*10.0*	*15.7*		*15.7*
LOS	*A*	*A*	*C*		*B*	*C*		*C*
Approach Delay (s/veh)	--	--	*12.7*			*15.7*		
Approach LOS	--	--	*B*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*13th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*11/2/2006*	Analysis Year	*Ex. 2006*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *13th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*82*	*523*	*290*	*21*	*0*	*13*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*6*	*15*	*0*	*0*	*43*	*20*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*14*	*0*	*0*	*39*	*18*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*23*	*0*	*14*	*91*	*581*	*322*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*91*	*23*	*43*		*20*		*21*	
C (m) (veh/h)	*1591*	*745*	*280*		*510*		*180*	
v/c	*0.06*	*0.03*	*0.15*		*0.04*		*0.12*	
95% queue length	*0.18*	*0.10*	*0.53*		*0.12*		*0.39*	
Control Delay (s/veh)	*7.4*	*10.0*	*20.2*		*12.3*		*27.6*	
LOS	*A*	*A*	*C*		*B*		*D*	
Approach Delay (s/veh)	--	--	*17.7*			*27.6*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*11/2/2006*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*13th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *13th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*7*	*37*	*57*	*12*	*491*	*2*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*4*	*11*	*36*	*227*	*8*	*2*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*10*	*33*	*205*	*8*	*2*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*13*	*545*	*2*	*7*	*41*	*63*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*7*	*13*	*235*		*2*		*51*	
C (m) (veh/h)	*1012*	*1475*	*342*		*1024*		*468*	
v/c	*0.01*	*0.01*	*0.69*		*0.00*		*0.11*	
95% queue length	*0.02*	*0.03*	*4.84*		*0.01*		*0.36*	
Control Delay (s/veh)	*8.6*	*7.5*	*35.7*		*8.5*		*13.6*	
LOS	*A*	*A*	*E*		*A*		*B*	
Approach Delay (s/veh)	--	--	*35.5*			*13.6*		
Approach LOS	--	--	*E*			*B*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*Wiley*	Intersection	*14 - Gate 22B & Loop*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	AM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*1*	*1*	*1*	*1*		*2*		*2*			
Lane Group		*T*	*R*	*L*	*T*		*L*		*R*			
Volume, V (vph)		*0*	*0*	*0*	*0*		*953*		*874*			
% Heavy Vehicles, %HV		*0*	*0*	*0*	*0*		*0*		*0*			
Peak-Hour Factor, PHF		*0.90*	*0.90*	*0.90*	*0.90*		*0.90*		*0.90*			
Pretimed (P) or Actuated (A)		*A*	*A*	*A*	*A*		*A*		*A*			
Start-up Lost Time, l_1		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Extension of Effective Green, e		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Arrival Type, AT		*3*	*3*	*3*	*3*		*3*		*3*			
Unit Extension, UE		*3.0*	*3.0*	*3.0*	*3.0*		*3.0*		*3.0*			
Filtering/Metering, I		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Initial Unmet Demand, Q_b		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*			
Lane Width		*12.0*	*12.0*	*12.0*	*12.0*		*12.0*		*12.0*			
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*			
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*	*0*	*0*		*0*		*0*			
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*					

Phasing	EW Perm	02	03	04	NB Only	06	07	08
Timing	G = *5.0*	G =	G =	G =	G = *45.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*0*	*0*	*0*	*0*		*1059*		*971*			
Lane Group Capacity, c		*158*	*1615*	*127*	*158*		*2629*		*2144*			
v/c Ratio, X		*0.00*	*0.00*	*0.00*	*0.00*		*0.40*		*0.45*			
Total Green Ratio, g/C		*0.08*	*1.00*	*0.08*	*0.08*		*0.75*		*0.75*			
Uniform Delay, d_1		*25.2*	*0.0*	*25.2*	*25.2*		*2.7*		*2.8*			
Progression Factor, PF		*1.000*	*0.950*	*1.000*	*1.000*		*1.000*		*1.000*			
Delay Calibration, k		*0.11*	*0.11*	*0.11*	*0.11*		*0.11*		*0.11*			
Incremental Delay, d_2		*0.0*	*0.0*	*0.0*	*0.0*		*0.1*		*0.2*			
Initial Queue Delay, d_3		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Control Delay		*25.2*	*0.0*	*25.2*	*25.2*		*2.8*		*3.0*			
Lane Group LOS		*C*	*A*	*C*	*C*		*A*		*A*			
Approach Delay							*2.9*					
Approach LOS							*A*					
Intersection Delay	*2.9*			X_C = *0.41*			Intersection LOS			*A*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*Wiley*	Intersection	*14 - Gate 22B & Loop*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*1*	*1*	*1*	*1*		*2*		*2*			
Lane Group		*T*	*R*	*L*	*T*		*L*		*R*			
Volume, V (vph)		*4*	*1106*	*899*	*4*		*78*		*76*			
% Heavy Vehicles, %HV		*0*	*0*	*0*	*0*		*0*		*0*			
Peak-Hour Factor, PHF		*0.90*	*0.90*	*0.90*	*0.90*		*0.90*		*0.90*			
Pretimed (P) or Actuated (A)		*A*	*A*	*A*	*A*		*A*		*A*			
Start-up Lost Time, l_1		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Extension of Effective Green, e		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Arrival Type, AT		*3*	*3*	*3*	*3*		*3*		*3*			
Unit Extension, UE		*3.0*	*3.0*	*3.0*	*3.0*		*3.0*		*3.0*			
Filtering/Metering, I		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Initial Unmet Demand, Q_b		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*			
Lane Width		*12.0*	*12.0*	*12.0*	*12.0*		*12.0*		*12.0*			
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*			
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*	*0*	*0*		*0*		*0*			
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*					

Phasing	EW Perm	02	03	04	NB Only	06	07	08
Timing	G = *43.0*	G =	G =	G =	G = *7.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*4*	*1229*	*999*	*4*		*87*		*84*			
Lane Group Capacity, c		*1362*	*1615*	*1028*	*1362*		*409*		*334*			
v/c Ratio, X		*0.00*	*0.76*	*0.97*	*0.00*		*0.21*		*0.25*			
Total Green Ratio, g/C		*0.72*	*1.00*	*0.72*	*0.72*		*0.12*		*0.12*			
Uniform Delay, d_1		*2.4*	*0.0*	*7.9*	*2.4*		*24.0*		*24.1*			
Progression Factor, PF		*1.000*	*0.950*	*1.000*	*1.000*		*1.000*		*1.000*			
Delay Calibration, k		*0.11*	*0.31*	*0.48*	*0.11*		*0.11*		*0.11*			
Incremental Delay, d_2		*0.0*	*2.2*	*21.4*	*0.0*		*0.3*		*0.4*			
Initial Queue Delay, d_3		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Control Delay		*2.4*	*2.2*	*29.4*	*2.4*		*24.3*		*24.5*			
Lane Group LOS		*A*	*A*	*C*	*A*		*C*		*C*			
Approach Delay	*2.2*			*29.3*			*24.4*					
Approach LOS	*A*			*C*			*C*					
Intersection Delay	*15.0*			X_C = *0.76*			Intersection LOS			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*16 - 12th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*2/7/2007*	Analysis Year	*Ex. 2006*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *12th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*35*	*440*	*75*	*5*	*25*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*5*	*5*	*0*	*5*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*5*	*5*	*0*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*27*	*5*	*38*	*488*	*83*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*38*	*5*		*10*			*10*	
C (m) (veh/h)	*1567*	*992*		*439*			*541*	
v/c	*0.02*	*0.01*		*0.02*			*0.02*	
95% queue length	*0.07*	*0.02*		*0.07*			*0.06*	
Control Delay (s/veh)	*7.4*	*8.6*		*13.4*			*11.8*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*13.4*			*11.8*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*2/7/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*16 - 12th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *12th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*30*	*5*	*10*	*430*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*22*	*66*	*0*	*5*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*20*	*60*	*0*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*11*	*477*	*5*	*5*	*33*	*5*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*5*	*11*		*71*			*27*	
C (m) (veh/h)	*1070*	*1559*		*434*			*548*	
v/c	*0.00*	*0.01*		*0.16*			*0.05*	
95% queue length	*0.01*	*0.02*		*0.58*			*0.16*	
Control Delay (s/veh)	*8.4*	*7.3*		*14.9*			*11.9*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*14.9*			*11.9*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/27/2007*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*19 - 10th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*160*	*125*	*60*	*15*	*50*	*60*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*50*	*22*	*5*	*11*	*5*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*45*	*20*	*5*	*10*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*16*	*55*	*66*	*177*	*138*	*66*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*177*	*16*		*21*			*77*	
C (m) (veh/h)	*1454*	*1356*		*365*			*399*	
v/c	*0.12*	*0.01*		*0.06*			*0.19*	
95% queue length	*0.41*	*0.04*		*0.18*			*0.71*	
Control Delay (s/veh)	*7.8*	*7.7*		*15.5*			*16.2*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*15.5*			*16.2*		
Approach LOS	--	--	*C*			*C*		

HCS+™ Version 5.2

Generated: 2/8/2007 10:06 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/27/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*19 - 10th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*Ex. 2006*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*30*	*0*	*5*	*175*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*38*	*27*	*155*	*66*	*16*	*16*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*25*	*140*	*60*	*15*	*15*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*194*	*5*	*11*	*33*	*0*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*11*	*5*		*98*			*220*	
C (m) (veh/h)	*1361*	*1566*		*539*			*768*	
v/c	*0.01*	*0.00*		*0.18*			*0.29*	
95% queue length	*0.02*	*0.01*		*0.66*			*1.18*	
Control Delay (s/veh)	*7.7*	*7.3*		*13.2*			*11.6*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*13.2*			*11.6*		
Approach LOS	--	--	*B*			*B*		

HCS+™ Version 5.2

Generated: 2/8/2007 10:04 PM

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*21- 5th & National*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*1/22/2007*	Jurisdiction	*WPAFB*
Time Period	AM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*TR*			*LTR*	
Volume, V (vph)	*67*	*2*	*48*	*13*	*24*	*3*	*536*	*214*	*33*	*4*	*199*	*521*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*			*2.0*	
Arrival Type, AT		*3*	*3*		*3*	*3*	*3*	*3*			*3*	
Unit Extension, UE		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*			*3.0*	
Filtering/Metering, I		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*	*0*	*0*	*0*			*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = *9.0*	G =	G =	G =	G = *19.0*	G = *33.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y =	Y = *5*	Y =	Y =

Duration of Analysis, T = *0.25* | Cycle Length, C = *75.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*76*	*53*		*41*	*3*	*596*	*275*			*804*	
Lane Group Capacity, c		*154*	*186*		*192*	*186*	*600*	*1337*			*725*	
v/c Ratio, X		*0.49*	*0.28*		*0.21*	*0.02*	*0.99*	*0.21*			*1.11*	
Total Green Ratio, g/C		*0.12*	*0.12*		*0.12*	*0.12*	*0.75*	*0.75*			*0.44*	
Uniform Delay, d_1		*30.9*	*30.1*		*29.8*	*29.1*	*17.5*	*2.8*			*21.0*	
Progression Factor, PF		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*			*1.000*	
Delay Calibration, k		*0.11*	*0.11*		*0.11*	*0.11*	*0.49*	*0.11*			*0.50*	
Incremental Delay, d_2		*2.5*	*0.8*		*0.6*	*0.0*	*35.0*	*0.1*			*67.4*	
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*			*0.0*	
Control Delay		*33.3*	*30.9*		*30.4*	*29.1*	*52.5*	*2.9*			*88.4*	
Lane Group LOS		*C*	*C*		*C*	*C*	*D*	*A*			*F*	
Approach Delay	*32.3*			*30.3*			*36.8*			*88.4*		
Approach LOS	*C*			*C*			*D*			*F*		
Intersection Delay	*58.8*			X_C = *0.92*			Intersection LOS			*E*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*21- 5th & National*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*1/22/2007*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*TR*			*LTR*	
Volume, V (vph)	*475*	*15*	*408*	*14*	*6*	*4*	*31*	*429*	*14*	*8*	*503*	*44*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*			*2.0*	
Arrival Type, AT		*3*	*3*		*3*	*3*	*3*	*3*			*3*	
Unit Extension, UE		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*			*3.0*	
Filtering/Metering, I		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*	*0*	*0*	*0*			*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = *15.0*	G = *15.0*	G =	G =	G = *31.0*	G =	G =	G =
	Y =	Y = *5*	Y =	Y =	Y = *5*	Y =	Y =	Y =

Duration of Analysis, T = *0.25* Cycle Length, C = *75.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*545*	*453*		*23*	*4*	*34*	*493*			*617*	
Lane Group Capacity, c		*660*	*704*		*246*	*311*	*223*	*751*			*742*	
v/c Ratio, X		*0.83*	*0.64*		*0.09*	*0.01*	*0.15*	*0.66*			*0.83*	
Total Green Ratio, g/C		*0.45*	*0.45*		*0.20*	*0.20*	*0.41*	*0.41*			*0.41*	
Uniform Delay, d_1		*17.9*	*15.8*		*24.5*	*24.1*	*13.8*	*17.7*			*19.7*	
Progression Factor, PF		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*			*1.000*	
Delay Calibration, k		*0.36*	*0.22*		*0.11*	*0.11*	*0.11*	*0.23*			*0.37*	
Incremental Delay, d_2		*8.5*	*2.0*		*0.2*	*0.0*	*0.3*	*2.1*			*8.0*	
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*			*0.0*	
Control Delay		*26.4*	*17.8*		*24.6*	*24.1*	*14.1*	*19.8*			*27.7*	
Lane Group LOS		*C*	*B*		*C*	*C*	*B*	*B*			*C*	
Approach Delay	*22.5*			*24.5*			*19.4*			*27.7*		
Approach LOS	*C*			*C*			*B*			*C*		
Intersection Delay	*23.3*			X_C = *0.81*			Intersection LOS			*C*		

HCS+™ Version 5.2
Generated: 2/9/2007 9:37 AM

HCS+™ DETAILED REPORT

General Information	***Site Information***	
Analyst	Intersection	*22 - Kauffman & National*
Agency or Co. *KZF Design*	Area Type	*All other areas*
Date Performed *11/1/2006*	Jurisdiction	*WPAFB*
Time Period AM Peak	Analysis Year	
	Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*1*	*1*	*1*	*1*		*1*		*1*			
Lane Group		*T*	*R*	*L*	*T*		*L*		*R*			
Volume, V (vph)		*466*	*512*	*88*	*262*		*259*		*57*			
% Heavy Vehicles, %HV		*0*	*0*	*0*	*0*		*0*		*0*			
Peak-Hour Factor, PHF		*0.90*	*0.90*	*0.90*	*0.90*		*0.90*		*0.90*			
Pretimed (P) or Actuated (A)		*A*	*A*	*A*	*A*		*A*		*A*			
Start-up Lost Time, l_1		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Extension of Effective Green, e		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Arrival Type, AT		*3*	*3*	*3*	*3*		*3*		*3*			
Unit Extension, UE		*3.0*	*3.0*	*3.0*	*3.0*		*3.0*		*3.0*			
Filtering/Metering, I		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Initial Unmet Demand, Q_b		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*			
Lane Width		*12.0*	*12.0*	*12.0*	*12.0*		*12.0*		*12.0*			
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*			
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*	*0*	*0*		*0*		*0*			
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*					

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = *7.0*	G = *25.0*	G =	G =	G = *14.0*	G =	G =	G =
	Y = *4*	Y = *5*	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*					Cycle Length, C = *60.0*			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*518*	*569*	*98*	*291*		*288*		*63*			
Lane Group Capacity, c		*792*	*673*	*433*	*1140*		*421*		*377*			
v/c Ratio, X		*0.65*	*0.85*	*0.23*	*0.26*		*0.68*		*0.17*			
Total Green Ratio, g/C		*0.42*	*0.42*	*0.60*	*0.60*		*0.23*		*0.23*			
Uniform Delay, d_1		*14.0*	*15.8*	*6.9*	*5.7*		*21.0*		*18.3*			
Progression Factor, PF		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Delay Calibration, k		*0.23*	*0.38*	*0.11*	*0.11*		*0.25*		*0.11*			
Incremental Delay, d_2		*2.0*	*9.7*	*0.3*	*0.1*		*4.5*		*0.2*			
Initial Queue Delay, d_3		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Control Delay		*16.0*	*25.5*	*7.2*	*5.8*		*25.5*		*18.6*			
Lane Group LOS		*B*	*C*	*A*	*A*		*C*		*B*			
Approach Delay	*21.0*			*6.1*			*24.3*					
Approach LOS	*C*			*A*			*C*					
Intersection Delay	*18.4*			X_C = *0.75*			Intersection LOS			*B*		

HCS+™ Version 5.2 Generated: 11/3/2006 6:00 AM

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*Wiley*	Intersection	*22 - Kauffman & National*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*11/1/2006*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*COE JV-WPAFB IAM Infrastructure RFP*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		*1*	*1*	*1*	*1*		*1*		*1*			
Lane Group		*T*	*R*	*L*	*T*		*L*		*R*			
Volume, V (vph)		*386*	*473*	*30*	*290*		*634*		*119*			
% Heavy Vehicles, %HV		*0*	*0*	*0*	*0*		*0*		*0*			
Peak-Hour Factor, PHF		*0.90*	*0.90*	*0.90*	*0.90*		*0.90*		*0.90*			
Pretimed (P) or Actuated (A)		*A*	*A*	*A*	*A*		*A*		*A*			
Start-up Lost Time, l_1		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Extension of Effective Green, e		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*		*2.0*			
Arrival Type, AT		*3*	*3*	*3*	*3*		*3*		*3*			
Unit Extension, UE		*3.0*	*3.0*	*3.0*	*3.0*		*3.0*		*3.0*			
Filtering/Metering, I		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Initial Unmet Demand, Q_b		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*			
Lane Width		*12.0*	*12.0*	*12.0*	*12.0*		*12.0*		*12.0*			
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*			
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*	*0*	*0*		*0*		*0*			
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*				

Phasing	EW Perm	02	03	04	NB Only	06	07	08
Timing	G = *23.0*	G =	G =	G =	G = *27.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*429*	*526*	*33*	*322*		*704*		*132*			
Lane Group Capacity, c		*728*	*619*	*266*	*728*		*812*		*727*			
v/c Ratio, X		*0.59*	*0.85*	*0.12*	*0.44*		*0.87*		*0.18*			
Total Green Ratio, g/C		*0.38*	*0.38*	*0.38*	*0.38*		*0.45*		*0.45*			
Uniform Delay, d_1		*14.7*	*16.9*	*12.0*	*13.7*		*14.9*		*9.9*			
Progression Factor, PF		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*		*1.000*			
Delay Calibration, k		*0.18*	*0.38*	*0.11*	*0.11*		*0.40*		*0.11*			
Incremental Delay, d_2		*1.3*	*10.9*	*0.2*	*0.4*		*9.8*		*0.1*			
Initial Queue Delay, d_3		*0.0*	*0.0*	*0.0*	*0.0*		*0.0*		*0.0*			
Control Delay		*16.0*	*27.8*	*12.2*	*14.2*		*24.7*		*10.0*			
Lane Group LOS		*B*	*C*	*B*	*B*		*C*		*B*			
Approach Delay	*22.5*			*14.0*			*22.4*					
Approach LOS	*C*			*B*			*C*					
Intersection Delay	*21.0*			X_C = *0.86*			Intersection LOS			*C*		

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Projected Operations
8th Street Gate
8 - 5th & Hobson

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*8 - 5th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed		Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *5th St.*	North/South Street: *Hobson*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*130*	*130*	*579*	*129*	*43*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*18*	*116*	*0*	*20*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*0*
Configuration	*L*		*TR*	*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*17*	*105*	*0*	*18*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*143*	*47*	*0*	*144*	*144*	*643*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LTR*	*LT*		*TR*	*LT*		*TR*
v (veh/h)	*144*	*143*	*116*		*20*	*5*		*18*
C (m) (veh/h)	*1548*	*823*	*149*		*592*	*147*		*1017*
v/c	*0.09*	*0.17*	*0.78*		*0.03*	*0.03*		*0.02*
95% queue length	*0.31*	*0.63*	*4.85*		*0.10*	*0.11*		*0.05*
Control Delay (s/veh)	*7.6*	*10.3*	*84.0*		*11.3*	*30.4*		*8.6*
LOS	*A*	*B*	*F*		*B*	*D*		*A*
Approach Delay (s/veh)	--	--	*73.3*			*13.3*		
Approach LOS	--	--	*F*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/24/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*8 - 5th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*2010*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *5th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*14*	*41*	*100*	*24*	*73*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*143*	*561*	*0*	*140*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*0*
Configuration	*L*		*TR*	*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*129*	*505*	*0*	*126*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*26*	*81*	*0*	*15*	*45*	*111*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*		*TR*	*LT*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LTR*	*LT*		*TR*	*LT*		*TR*
v (veh/h)	*15*	*26*	*561*		*140*	*5*		*143*
C (m) (veh/h)	*1504*	*1412*	*514*		*950*	*514*		*973*
v/c	*0.01*	*0.02*	*1.09*		*0.15*	*0.01*		*0.15*
95% queue length	*0.03*	*0.06*	*17.74*		*0.52*	*0.03*		*0.51*
Control Delay (s/veh)	*7.4*	*7.6*	*94.7*		*9.4*	*12.1*		*9.3*
LOS	*A*	*A*	*F*		*A*	*B*		*A*
Approach Delay (s/veh)	--	--	*77.7*			*9.4*		
Approach LOS	--	--	*F*			*A*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/24/2007*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*8 - 5th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*2010*

Project Description *SBLt, EB/WB Lt. and 5 Ln South Approach*

East/West Street:

North/South Street: *Hobson*

Intersection Orientation: *North-South*

Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*130*	*130*	*579*	*129*	*43*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*18*	*116*	*0*	*20*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*0*	*1*	*0*
Configuration	*L*	*T*	*R*	*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*17*	*105*	*0*	*18*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*143*	*47*	*0*	*144*	*144*	*643*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LTR*	*L*		*TR*	*L*		*TR*
v (veh/h)	*144*	*143*	*116*		*20*	*5*		*18*
C (m) (veh/h)	*1548*	*823*	*247*		*898*	*148*		*1017*
v/c	*0.09*	*0.17*	*0.47*		*0.02*	*0.03*		*0.02*
95% queue length	*0.31*	*0.63*	*2.33*		*0.07*	*0.10*		*0.05*
Control Delay (s/veh)	*7.6*	*10.3*	*31.8*		*9.1*	*30.2*		*8.6*
LOS	*A*	*B*	*D*		*A*	*D*		*A*
Approach Delay (s/veh)	--	--	*28.5*			*13.3*		
Approach LOS	--	--	*D*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/24/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*8 - 5th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*2010*

Project Description *SBLt, EB/WB Lt. and 5 Ln South App. (SBLt. adj -100 veh/hr)*

East/West Street: *5th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*14*	*41*	*100*	*24*	*73*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*143*	*450*	*0*	*140*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*5*	*0*	*129*	*405*	*0*	*126*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*26*	*81*	*0*	*15*	*45*	*111*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*L*		*TR*	*L*		*TR*
v (veh/h)	*15*	*26*	*450*		*140*	*5*		*143*
C (m) (veh/h)	*1504*	*1412*	*558*		*1019*	*521*		*973*
v/c	*0.01*	*0.02*	*0.81*		*0.14*	*0.01*		*0.15*
95% queue length	*0.03*	*0.06*	*7.89*		*0.48*	*0.03*		*0.51*
Control Delay (s/veh)	*7.4*	*7.6*	*33.0*		*9.1*	*12.0*		*9.3*
LOS	*A*	*A*	*D*		*A*	*B*		*A*
Approach Delay (s/veh)	--	--	*27.3*			*9.4*		
Approach LOS	--	--	*D*			*A*		

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11 - 13th & Hobson

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*11 - 13th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *13th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*82*	*744*	*267*	*229*	*44*	*13*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*6*	*15*	*0*	*11*	*43*	*28*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*14*	*0*	*10*	*39*	*26*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*254*	*48*	*14*	*91*	*826*	*296*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*91*	*254*		*82*			*21*	
C (m) (veh/h)	*1528*	*615*		*78*			*30*	
v/c	*0.06*	*0.41*		*1.05*			*0.70*	
95% queue length	*0.19*	*2.02*		*5.80*			*2.30*	
Control Delay (s/veh)	*7.5*	*14.9*		*210.9*			*263.3*	
LOS	*A*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*210.9*			*263.3*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/24/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*11 - 13th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*2010*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *13th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*7*	*97*	*72*	*29*	*782*	*2*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*4*	*11*	*36*	*312*	*8*	*65*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*	*10*	*33*	*281*	*8*	*59*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*32*	*868*	*2*	*7*	*107*	*80*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*7*	*32*		*385*			*51*	
C (m) (veh/h)	*766*	*1375*		*191*			*275*	
v/c	*0.01*	*0.02*		*2.02*			*0.19*	
95% queue length	*0.03*	*0.07*		*29.20*			*0.67*	
Control Delay (s/veh)	*9.7*	*7.7*		*515.7*			*21.0*	
LOS	*A*	*A*		*F*			*C*	
Approach Delay (s/veh)	--	--	*515.7*			*21.0*		
Approach LOS	--	--	*F*			*C*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*11- 13th & Hobson*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/13/2007*	Jurisdiction	*WPAFB*
Time Period	AM Peak	Analysis Year	
		Project ID	*Added Traffic Signal*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*0*
Lane Group		*LTR*			*LT*	*R*	*L*	*T*	*R*	*L*	*TR*	
Volume, V (vph)	*6*	*14*	*0*	*0*	*49*	*23*	*82*	*744*	*267*	*229*	*0*	*57*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e		*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT		*3*			*3*	*3*	*3*	*3*	*3*	*3*	*3*	
Unit Extension, UE		*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I		*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b		*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*			*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *12.0*	G =	G =	G =	G = *12.0*	G = *37.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *4*	Y = *5*	Y =	Y =

Duration of Analysis, T = *0.25* | Cycle Length, C = *75.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*23*			*54*	*26*	*91*	*827*	*297*	*254*	*63*	
Lane Group Capacity, c		*270*			*292*	*248*	*645*	*901*	*766*	*375*	*1097*	
v/c Ratio, X		*0.09*			*0.18*	*0.10*	*0.14*	*0.92*	*0.39*	*0.68*	*0.06*	
Total Green Ratio, g/C		*0.16*			*0.16*	*0.16*	*0.49*	*0.49*	*0.49*	*0.71*	*0.71*	
Uniform Delay, d_1		*26.8*			*27.3*	*26.9*	*10.3*	*17.6*	*11.9*	*17.7*	*3.4*	
Progression Factor, PF		*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k		*0.11*			*0.11*	*0.11*	*0.11*	*0.44*	*0.11*	*0.25*	*0.11*	
Incremental Delay, d_2		*0.1*			*0.3*	*0.2*	*0.1*	*14.1*	*0.3*	*4.8*	*0.0*	
Initial Queue Delay, d_3		*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay		*27.0*			*27.6*	*27.1*	*10.4*	*31.7*	*12.2*	*22.5*	*3.4*	
Lane Group LOS		*C*			*C*	*C*	*B*	*C*	*B*	*C*	*A*	
Approach Delay	*27.0*			*27.4*			*25.3*			*18.7*		
Approach LOS	*C*			*C*			*C*			*B*		
Intersection Delay	*24.2*			X_C = *0.79*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*11- 13th & Hobson*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/13/2007*	Jurisdiction	*WPAFB*
Time Period	PM Peak	Analysis Year	
		Project ID	*Added Traffic Signal*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*0*
Lane Group		*LTR*			*LT*	*R*	*L*	*T*	*R*	*L*	*TR*	
Volume, V (vph)	*4*	*10*	*33*	*281*	*8*	*59*	*7*	*97*	*72*	*20*	*782*	*2*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e		*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT		*3*			*3*	*3*	*3*	*3*	*3*	*3*	*3*	
Unit Extension, UE		*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I		*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b		*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*			*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *18.0*	G =	G =	G =	G = *32.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*52*			*321*	*66*	*8*	*108*	*80*	*22*	*871*	
Lane Group Capacity, c		*482*			*380*	*466*	*122*	*974*	*828*	*670*	*974*	
v/c Ratio, X		*0.11*			*0.84*	*0.14*	*0.07*	*0.11*	*0.10*	*0.03*	*0.89*	
Total Green Ratio, g/C		*0.30*			*0.30*	*0.30*	*0.53*	*0.53*	*0.53*	*0.53*	*0.53*	
Uniform Delay, d_1		*15.2*			*19.7*	*15.4*	*6.8*	*6.9*	*6.9*	*6.6*	*12.5*	
Progression Factor, PF		*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k		*0.11*			*0.38*	*0.11*	*0.11*	*0.11*	*0.11*	*0.11*	*0.42*	
Incremental Delay, d_2		*0.1*			*15.9*	*0.1*	*0.2*	*0.1*	*0.1*	*0.0*	*10.7*	
Initial Queue Delay, d_3		*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay		*15.3*			*35.6*	*15.5*	*7.0*	*7.0*	*6.9*	*6.7*	*23.2*	
Lane Group LOS		*B*			*D*	*B*	*A*	*A*	*A*	*A*	*C*	
Approach Delay	*15.3*			*32.2*			*7.0*			*22.7*		
Approach LOS	*B*			*C*			*A*			*C*		
Intersection Delay	*22.9*			X_C = *0.88*			Intersection LOS			*C*		

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14 - 8th & Skyline

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*14 - 8th & Skyline*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *8th St.* North/South Street: *Skyline*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)				*340*		*85*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*377*	*0*	*94*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration				*LTR*	*LR*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)		*50*	*45*	*35*	*10*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*55*	*50*	*38*	*11*	*0*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*4*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LTR*			*TR*	*LT*		
v (veh/h)		*377*			*105*	*49*		
C (m) (veh/h)		*1610*			*364*	*189*		
v/c		*0.23*			*0.29*	*0.26*		
95% queue length		*0.91*			*1.17*	*0.99*		
Control Delay (s/veh)		*7.9*			*18.9*	*30.6*		
LOS		*A*			*C*	*D*		
Approach Delay (s/veh)	--	--	*18.9*			*30.6*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*14 - 8th & Skyline*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *8th St.* North/South Street: *Skyline*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*50*	*45*	*35*	*10*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*377*	*0*	*94*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*340*		*85*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*38*	*11*	*0*	*0*	*55*	*50*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*38*		*471*				
C (m) (veh/h)		*1474*		*828*				
v/c		*0.03*		*0.57*				
95% queue length		*0.08*		*3.66*				
Control Delay (s/veh)		*7.5*		*14.9*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*14.9*					
Approach LOS	--	--	*B*					

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15 - 8th & Hobson

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*Wiley*	Intersection	*15- 8th & Hobson*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/13/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*Added Traffic Signal*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*0*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*TR*		*L*	*TR*	
Volume, V (vph)	*0*	*95*	*0*	*511*	*445*	*447*	*40*	*317*	*61*	*64*	*109*	*0*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green, e	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*		*3*	*3*	
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Initial Unmet Demand, Q_b	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = *20.0*	G = *18.0*	G =	G =	G = *22.0*	G =	G =	G =
	Y = *4*	Y = *5*	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*					Cycle Length, C = *74.0*			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*0*	*106*		*568*	*494*	*497*	*44*	*420*		*71*	*121*	
Lane Group Capacity, c	*215*	*444*		*784*	*1037*	*881*	*369*	*530*		*143*	*543*	
v/c Ratio, X	*0.00*	*0.24*		*0.72*	*0.48*	*0.56*	*0.12*	*0.79*		*0.50*	*0.22*	
Total Green Ratio, g/C	*0.24*	*0.24*		*0.57*	*0.57*	*0.57*	*0.30*	*0.30*		*0.30*	*0.30*	
Uniform Delay, d_1	*21.2*	*22.5*		*10.4*	*9.5*	*10.2*	*18.9*	*23.9*		*21.4*	*19.6*	
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*	*0.11*		*0.29*	*0.11*	*0.16*	*0.11*	*0.34*		*0.11*	*0.11*	
Incremental Delay, d_2	*0.0*	*0.3*		*3.4*	*0.3*	*0.8*	*0.1*	*8.1*		*2.7*	*0.2*	
Initial Queue Delay, d_3	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Control Delay	*21.2*	*22.8*		*13.8*	*9.8*	*11.0*	*19.1*	*32.0*		*24.1*	*19.8*	
Lane Group LOS	*C*	*C*		*B*	*A*	*B*	*B*	*C*		*C*	*B*	
Approach Delay	*22.8*			*11.7*			*30.8*			*21.4*		
Approach LOS	*C*			*B*			*C*			*C*		
Intersection Delay	*16.8*			X_C = *0.69*			Intersection LOS			*B*		

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*15- 8th & Hobson*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/13/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*Added Traffic Signal - Needs NBRt.*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*0*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*TR*		*L*	*TR*	
Volume, V (vph)	*15*	*240*	*40*	*33*	*25*	*47*	*0*	*80*	*400*	*302*	*433*	*0*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green, e	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*		*3*	*3*	
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Initial Unmet Demand, Q_b	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	EW Perm	03	04	SB Only	NS Perm	07	08
Timing	G = *7.0*	G = *14.0*	G =	G =	G = *11.0*	G = *25.0*	G =	G =
	Y = *4*	Y = *5*	Y =	Y =	Y = *4*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *75.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*17*	*311*		*37*	*28*	*52*	*0*	*533*		*336*	*481*	
Lane Group Capacity, c	*252*	*334*		*259*	*609*	*518*	*298*	*533*		*352*	*974*	
v/c Ratio, X	*0.07*	*0.93*		*0.14*	*0.05*	*0.10*	*0.00*	*1.00*		*0.95*	*0.49*	
Total Green Ratio, g/C	*0.19*	*0.19*		*0.33*	*0.33*	*0.33*	*0.33*	*0.33*		*0.53*	*0.53*	
Uniform Delay, d_1	*25.1*	*30.0*		*18.1*	*16.9*	*17.2*	*16.7*	*25.0*		*18.9*	*11.1*	
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*	*0.45*		*0.11*	*0.11*	*0.11*	*0.11*	*0.50*		*0.46*	*0.11*	
Incremental Delay, d_2	*0.1*	*32.0*		*0.3*	*0.0*	*0.1*	*0.0*	*39.0*		*36.1*	*0.4*	
Initial Queue Delay, d_3	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Control Delay	*25.2*	*62.0*		*18.4*	*17.0*	*17.3*	*16.7*	*64.0*		*54.9*	*11.5*	
Lane Group LOS	*C*	*E*		*B*	*B*	*B*	*B*	*E*		*D*	*B*	
Approach Delay	*60.1*			*17.6*			*64.0*			*29.4*		
Approach LOS	*E*			*B*			*E*			*C*		
Intersection Delay	*44.5*			X_C = *0.92*			Intersection LOS			*D*		

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18 - 10th & Skyline

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*18 - 10th & Skyline*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Skyline*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*15*	*80*	*10*	*10*	*115*	*60*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*17*	*90*	*11*	*11*	*130*	*68*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*80*	*10*	*35*	*10*	*25*	*160*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*90*	*11*	*39*	*11*	*28*	*181*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*4*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*17*	*11*		*140*			*220*	
C (m) (veh/h)	*1363*	*1479*		*496*			*801*	
v/c	*0.01*	*0.01*		*0.28*			*0.27*	
95% queue length	*0.04*	*0.02*		*1.15*			*1.12*	
Control Delay (s/veh)	*7.7*	*7.5*		*15.1*			*11.2*	
LOS	*A*	*A*		*C*			*B*	
Approach Delay (s/veh)	--	--	*15.1*			*11.2*		
Approach LOS	--	--	*C*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*18 - 10th & Skyline*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*PM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Skyline*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*170*	*230*	*5*	*5*	*25*	*5*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*193*	*261*	*5*	*5*	*28*	*5*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*20*	*5*	*35*	*25*	*10*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*
Hourly Flow Rate, HFR (veh/h)	*11*	*22*	*5*	*39*	*28*	*11*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*4*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*193*	*5*		*38*			*78*	
C (m) (veh/h)	*1566*	*1286*		*325*			*332*	
v/c	*0.12*	*0.00*		*0.12*			*0.23*	
95% queue length	*0.42*	*0.01*		*0.39*			*0.90*	
Control Delay (s/veh)	*7.6*	*7.8*		*17.5*			*19.1*	
LOS	*A*	*A*		*C*			*C*	
Approach Delay (s/veh)	--	--	*17.5*			*19.1*		
Approach LOS	--	--	*C*			*C*		

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19 - 10th & Hobson

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*19 - 10th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*1/24/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*100*	*456*	*60*	*158*	*162*	*60*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*11*	*50*	*22*	*5*	*11*	*64*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*45*	*20*	*5*	*10*	*58*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*175*	*180*	*66*	*111*	*506*	*66*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*111*	*175*		*80*			*83*	
C (m) (veh/h)	*1308*	*991*		*272*			*137*	
v/c	*0.08*	*0.18*		*0.29*			*0.61*	
95% queue length	*0.28*	*0.64*		*1.19*			*3.15*	
Control Delay (s/veh)	*8.0*	*9.4*		*23.7*			*65.2*	
LOS	*A*	*A*		*C*			*F*	
Approach Delay (s/veh)	--	--	*23.7*			*65.2*		
Approach LOS	--	--	*C*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Wiley*
Agency/Co.	*KZF Design*
Date Performed	*1/24/2007*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*19 - 10th & Hobson*
Jurisdiction	*WPAFB*
Analysis Year	*2010*

Project Description *COE JV-WPAFB IAM Infrastructure RFP*

East/West Street: *10th St.* North/South Street: *Hobson*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*147*	*5*	*29*	*578*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*100*	*27*	*155*	*66*	*16*	*303*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*0*
Configuration	*L*		*TR*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*90*	*25*	*140*	*60*	*15*	*273*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*32*	*642*	*5*	*11*	*163*	*5*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*11*	*32*		*385*			*282*	
C (m) (veh/h)	*929*	*1398*		*430*			*227*	
v/c	*0.01*	*0.02*		*0.90*			*1.24*	
95% queue length	*0.04*	*0.07*		*9.53*			*14.28*	
Control Delay (s/veh)	*8.9*	*7.6*		*52.5*			*184.2*	
LOS	*A*	*A*		*F*			*F*	
Approach Delay (s/veh)	--	--	*52.5*			*184.2*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*19 - 10th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed	*2/13/2007*	Analysis Year	*2010*
Analysis Time Period	*AM Peak*		

Project Description *EBLt.- WBRt./Lt. & 5 Ln Hobson*

East/West Street: *10th*	North/South Street: *Hobson*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*100*	*456*	*60*	*158*	*162*	*60*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*11*	*50*	*22*	*5*	*11*	*64*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*1*
Configuration	*L*		*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*	*45*	*20*	*5*	*10*	*58*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*175*	*180*	*66*	*111*	*506*	*66*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*1*	*1*	*0*
Configuration	*L*	*T*	*R*	*L*		*TR*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*L*		*TR*	*L*	*T*	*R*
v (veh/h)	*111*	*175*	*5*		*75*	*11*	*50*	*22*
C (m) (veh/h)	*1308*	*991*	*66*		*346*	*87*	*116*	*858*
v/c	*0.08*	*0.18*	*0.08*		*0.22*	*0.13*	*0.43*	*0.03*
95% queue length	*0.28*	*0.64*	*0.24*		*0.81*	*0.42*	*1.86*	*0.08*
Control Delay (s/veh)	*8.0*	*9.4*	*64.0*		*18.3*	*52.3*	*57.7*	*9.3*
LOS	*A*	*A*	*F*		*C*	*F*	*F*	*A*
Approach Delay (s/veh)	--	--	*21.1*			*44.2*		
Approach LOS	--	--	*C*			*E*		

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Recommend Hobson as 5 Lane north of 10th St.

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Wiley*	Intersection	*19 - 10th & Hobson*
Agency/Co.	*KZF Design*	Jurisdiction	*WPAFB*
Date Performed		Analysis Year	*2010*
Analysis Time Period	*PM Peak*		

Project Description *EBLt.- WBRt./Lt. & 5 Ln Hobson*

East/West Street: *10th*	North/South Street: *Hobson*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*10*	*147*	*5*	*29*	*578*	*5*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*100*	*27*	*155*	*66*	*16*	*303*
Percent Heavy Vehicles	*4*	--	--	*4*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*1*	*1*	*1*
Configuration	*L*		*TR*	*L*	*T*	*R*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*90*	*25*	*140*	*60*	*15*	*273*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*32*	*642*	*5*	*11*	*163*	*5*
Percent Heavy Vehicles	*4*	*4*	*4*	*4*	*4*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*1*	*0*	*1*	*1*
Configuration	*L*	*T*	*R*	*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*	*L*	*T*	*R*
v (veh/h)	*11*	*32*	*82*		*303*	*100*	*27*	*155*
C (m) (veh/h)	*929*	*1398*	*149*		*873*	*123*	*268*	*471*
v/c	*0.01*	*0.02*	*0.55*		*0.35*	*0.81*	*0.10*	*0.33*
95% queue length	*0.04*	*0.07*	*2.76*		*1.56*	*4.85*	*0.33*	*1.42*
Control Delay (s/veh)	*8.9*	*7.6*	*55.3*		*11.3*	*103.9*	*19.9*	*16.3*
LOS	*A*	*A*	*F*		*B*	*F*	*C*	*C*
Approach Delay (s/veh)	--	--	*20.7*			*47.7*		
Approach LOS	--	--	*C*			*E*		

HCS+™ Version 5.2 Generated: 2/13/2007 12:19 PM

Recommend Hobson as 5 Lane north of 10th St.

20 - 8th/Reese & National

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*Wiley*	Intersection	*20 - National & 8th (Gate)*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/8/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*COE JV-WPAFB IAM*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*0*
Lane Group	*L*	*TR*			*LT*	*R*	*L*	*TR*		*L*	*TR*	
Volume, V (vph)	*55*	*5*	*35*	*50*	*5*	*50*	*637*	*197*	*10*	*10*	*237*	*496*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green, e	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type, AT	*3*	*3*			*3*	*3*	*3*	*3*		*3*	*3*	
Unit Extension, UE	*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Initial Unmet Demand, Q_b	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*			*0*	*0*	*0*	*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = *8.0*	G =	G =	G =	G = *23.0*	G = *30.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *4*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *75.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*61*	*45*			*62*	*56*	*708*	*230*		*11*	*814*	
Lane Group Capacity, c	*140*	*169*			*139*	*166*	*629*	*1379*		*450*	*656*	
v/c Ratio, X	*0.44*	*0.27*			*0.45*	*0.34*	*1.13*	*0.17*		*0.02*	*1.24*	
Total Green Ratio, g/C	*0.11*	*0.11*			*0.11*	*0.11*	*0.76*	*0.76*		*0.40*	*0.40*	
Uniform Delay, d_1	*31.4*	*30.8*			*31.4*	*31.0*	*21.1*	*2.5*		*13.6*	*22.5*	
Progression Factor, PF	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*	*0.11*			*0.11*	*0.11*	*0.50*	*0.11*		*0.11*	*0.50*	
Incremental Delay, d_2	*2.2*	*0.8*			*2.3*	*1.2*	*75.7*	*0.1*		*0.0*	*121.0*	
Initial Queue Delay, d_3	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Control Delay	*33.6*	*31.6*			*33.7*	*32.3*	*96.8*	*2.5*		*13.7*	*143.5*	
Lane Group LOS	*C*	*C*			*C*	*C*	*F*	*A*		*B*	*F*	
Approach Delay	*32.7*			*33.0*			*73.7*			*141.8*		
Approach LOS	*C*			*C*			*E*			*F*		
Intersection Delay	*97.4*			X_C = *1.35*			Intersection LOS			*F*		

HCS+™ Version 5.2 Generated: 2/8/2007 10:05 AM

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*20 - National & 8th (Gate)*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/8/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*COE JV-WPAFB IAM*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*0*
Lane Group	*L*	*TR*			*LT*	*R*	*L*	*TR*		*L*	*TR*	
Volume, V (vph)	*393*	*5*	*322*	*20*	*0*	*20*	*12*	*447*	*40*	*40*	*799*	*31*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green, e	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type, AT	*3*	*3*			*3*	*3*	*3*	*3*		*3*	*3*	
Unit Extension, UE	*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Initial Unmet Demand, Q_b	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*			*0*	*0*	*0*	*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *20.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *60.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*437*	*364*			*22*	*22*	*13*	*541*		*44*	*922*	
Lane Group Capacity, c	*452*	*519*			*426*	*518*	*122*	*903*		*311*	*909*	
v/c Ratio, X	*0.97*	*0.70*			*0.05*	*0.04*	*0.11*	*0.60*		*0.14*	*1.01*	
Total Green Ratio, g/C	*0.33*	*0.33*			*0.33*	*0.33*	*0.50*	*0.50*		*0.50*	*0.50*	
Uniform Delay, d_1	*19.7*	*17.4*			*13.6*	*13.5*	*7.9*	*10.7*		*8.1*	*15.0*	
Progression Factor, PF	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.47*	*0.27*			*0.11*	*0.11*	*0.11*	*0.19*		*0.11*	*0.50*	
Incremental Delay, d_2	*33.7*	*4.2*			*0.1*	*0.0*	*0.4*	*1.1*		*0.2*	*33.5*	
Initial Queue Delay, d_3	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
Control Delay	*53.4*	*21.6*			*13.6*	*13.6*	*8.3*	*11.8*		*8.3*	*48.5*	
Lane Group LOS	*D*	*C*			*B*	*B*	*A*	*B*		*A*	*D*	
Approach Delay	*39.0*			*13.6*			*11.7*			*46.6*		
Approach LOS	*D*			*B*			*B*			*D*		
Intersection Delay	*35.2*			X_C = *1.00*			Intersection LOS			*D*		

HCS+™ Version 5.2 Generated: 2/8/2007 10:00 AM

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*20 - National & 8th (Gate)*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/8/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*SB Rt.*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*1*
Lane Group	*L*	*TR*			*LT*	*R*	*L*	*TR*		*L*	*T*	*R*
Volume, V (vph)	*55*	*5*	*35*	*50*	*5*	*50*	*637*	*197*	*10*	*10*	*237*	*496*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Extension of Effective Green, e	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*			*3*	*3*	*3*	*3*		*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*
Filtering/Metering, I	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
Initial Unmet Demand, Q_b	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*			*0*	*0*	*0*	*0*		*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = *8.0*	G =	G =	G =	G = *23.0*	G = *30.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *4*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *75.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*61*	*45*			*62*	*56*	*708*	*230*		*11*	*263*	*551*
Lane Group Capacity, c	*140*	*169*			*139*	*166*	*915*	*1379*		*450*	*731*	*621*
v/c Ratio, X	*0.44*	*0.27*			*0.45*	*0.34*	*0.77*	*0.17*		*0.02*	*0.36*	*0.89*
Total Green Ratio, g/C	*0.11*	*0.11*			*0.11*	*0.11*	*0.76*	*0.76*		*0.40*	*0.40*	*0.40*
Uniform Delay, d_1	*31.4*	*30.8*			*31.4*	*31.0*	*4.8*	*2.5*		*13.6*	*15.8*	*20.9*
Progression Factor, PF	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
Delay Calibration, k	*0.11*	*0.11*			*0.11*	*0.11*	*0.32*	*0.11*		*0.11*	*0.11*	*0.41*
Incremental Delay, d_2	*2.2*	*0.8*			*2.3*	*1.2*	*4.2*	*0.1*		*0.0*	*0.3*	*14.6*
Initial Queue Delay, d_3	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*
Control Delay	*33.6*	*31.6*			*33.7*	*32.3*	*9.0*	*2.5*		*13.7*	*16.1*	*35.5*
Lane Group LOS	*C*	*C*			*C*	*C*	*A*	*A*		*B*	*B*	*D*
Approach Delay	*32.7*			*33.0*			*7.4*			*29.0*		
Approach LOS	*C*			*C*			*A*			*C*		
Intersection Delay	*19.2*			X_C = *0.89*			Intersection LOS			*B*		

HCS+™ Version 5.2 Generated: 2/8/2007 10:06 AM

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*Wiley*	Intersection	*20 - National & 8th (Gate)*
Agency or Co.	*KZF Design*	Area Type	*All other areas*
Date Performed	*2/8/2007*	Jurisdiction	*WPAFB*
Time Period		Analysis Year	
		Project ID	*SB Rt.*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*1*
Lane Group	*L*	*TR*			*LT*	*R*	*L*	*TR*		*L*	*T*	*R*
Volume, V (vph)	*393*	*5*	*322*	*20*	*0*	*20*	*12*	*447*	*40*	*40*	*799*	*31*
% Heavy Vehicles, %HV	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Extension of Effective Green, e	*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*			*3*	*3*	*3*	*3*		*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*
Filtering/Metering, I	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
Initial Unmet Demand, Q_b	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*			*0*	*0*	*0*	*0*		*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = *24.0*	G =	G =	G =	G = *5.0*	G = *34.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *2*	Y = *5*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *75.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*437*	*364*			*22*	*22*	*13*	*541*		*44*	*888*	*34*
Lane Group Capacity, c	*434*	*498*			*407*	*497*	*213*	*987*		*354*	*828*	*704*
v/c Ratio, X	*1.01*	*0.73*			*0.05*	*0.04*	*0.06*	*0.55*		*0.12*	*1.07*	*0.05*
Total Green Ratio, g/C	*0.32*	*0.32*			*0.32*	*0.32*	*0.55*	*0.55*		*0.45*	*0.45*	*0.45*
Uniform Delay, d_1	*25.5*	*22.6*			*17.6*	*17.6*	*14.6*	*11.0*		*11.9*	*20.5*	*11.5*
Progression Factor, PF	*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
Delay Calibration, k	*0.50*	*0.29*			*0.11*	*0.11*	*0.11*	*0.15*		*0.11*	*0.50*	*0.11*
Incremental Delay, d_2	*44.9*	*5.5*			*0.1*	*0.0*	*0.1*	*0.7*		*0.2*	*52.6*	*0.0*
Initial Queue Delay, d_3	*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*
Control Delay	*70.4*	*28.1*			*17.7*	*17.6*	*14.8*	*11.7*		*12.0*	*73.1*	*11.5*
Lane Group LOS	*E*	*C*			*B*	*B*	*B*	*B*		*B*	*E*	*B*
Approach Delay	*51.2*			*17.7*			*11.7*			*68.1*		
Approach LOS	*D*			*B*			*B*			*E*		
Intersection Delay	*48.2*			X_C = *1.02*			Intersection LOS			*D*		

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